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THE JOURNAL

OF

THE ROYAL ASTRONOMICAL SOCIETY OF CANADA

DEVOTED TO THE ADVANCEMENT OF ASTRONOMY AND ALLIED SCIENCES

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Articles PAGE

Presidential Address ..... *William Findlay* 81
Photographing the Recent Grouping of the Planets (with Plates IV and V) ..... *Peter M. Millman* 87
By the Light of the Moon—Radio Talk ..... *H. Boyd Brydon* 89
The Hume Cronyn Memorial Observatory ..... *H. R. Kingston* 95
Annual General Meeting of the R.A.S.C.: Reports of the Recorder, General Secretary, Librarian and Secretaries of the Centres 98
Annual General Meeting: Reports of the General Treasurer and Treasurers of the Centres 110
Annual General Meeting: Officers for 1940 114

Meteor News

The Perseid Meteor Shower, 1939 (with Plates VI and VII) ..... *P.M.M.* 117

Notes and Queries

New Appointment for Mr. Andrew Thomson—British Expeditions for the Solar Eclipse of October 1, 1940—New Observatory for the University of Western Ontario—Harvard Summer Conference on Astronomy—Toronto Meeting of the A.A.V.S.O. (*F.S.H.*) 130

Meetings of the Society

Members Elected—Society At-Home—At Winnipeg—At Vancouver 133

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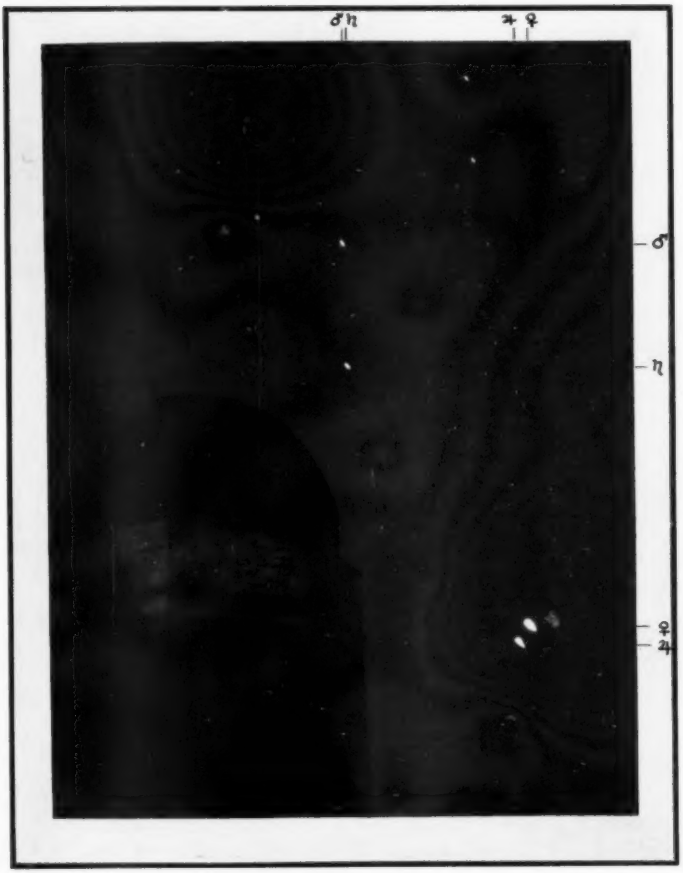
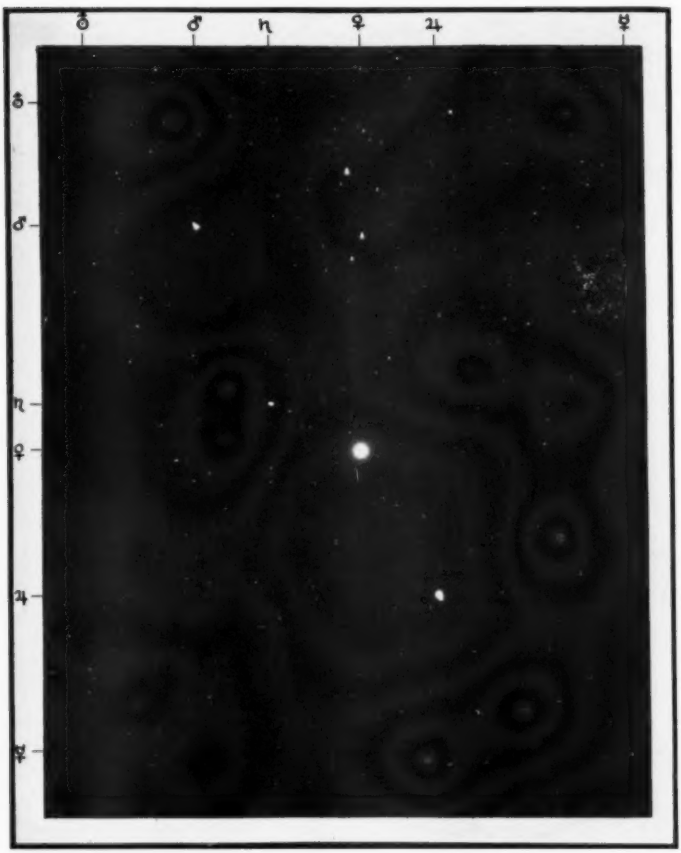
PLATE IV



The conjunction of Venus and Jupiter, photographed on February 20, 1940, at the Dunlap Observatory.

PLATE V



The six brightest planets, photographed on one plate at the Dunlap Observatory on March 1, 1940.

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Vol. XXXIV, No. 3 MARCH, 1940 Whole No. 292

THE ADDRESS OF THE PRESIDENT OF THE ROYAL ASTRONOMICAL SOCIETY OF CANADA

By William Findlay

MR. Chairman, members and friends of the Astronomical Society, the attendance of so many at this our annual social gathering, in a year when our nation and empire are preoccupied in a life and death struggle with forces of evil threatening the destruction of all we hold dear, is an evidence of your loyalty to our Society and to the science which it represents. It also demonstrates your patience and tolerance towards your retiring president, and is a testimony to the friendliness and good fellowship which characterizes all our gatherings.

It is not my purpose to impose upon you a second attempt at a formal paper concerning astronomy. Rather I propose that we think together concerning certain things of interest to our Society and perhaps pertaining to its welfare.

The progress of our Society depends largely upon the enthusiasm and support of all its members, particularly upon those of this important Toronto Centre. The Society was born here. The capable leadership of a noble succession of devoted Toronto workers, many of whom have passed on, has made the Society what it is. The responsibility for its future development rests largely upon you and those whom you may initiate into the inner circle in the days to come. It seemed to me that we could not do better here tonight than to think together concerning the sources of our strength and the field of opportunity that lies before us.

(Delivered at the Society's Annual At-Home, McLennan Laboratory, University of Toronto, Jan. 26th, 1940)

A year ago we pointed out that 1940 is the Jubilee year of our Society and that it is also closely associated with the hundredth anniversary of the beginning of observational work in this vicinity. Your Council has given continued attention to this matter during the past year and has plans under way for a special meeting of the Society at a more suitable season when we may look for a larger attendance of members from other Centres. The Toronto Centre will, I am sure, be glad to act as hosts to visiting members on that occasion. This gathering will likely be held during the Exhibition period next fall. One of our leaders, exceptionally well qualified for the task, has been asked to prepare a record of the genesis, the growth and the contributions of the Society, and this will be presented at the autumn meeting. Other interesting historical material is being prepared for publication and will appear in due time. I mention these plans at this time because it may be that some present may have valuable suggestions to make, which I am sure will be welcomed by your Council. In view of these arrangements there is no need that I should attempt tonight any general review of the history of the Society.

I wish to take advantage of this opportunity to express a hearty word of sincere appreciation of some to whom the Society owes much of its success, men with whom it has been my privilege to work on the Council during the recent years. It seems particularly fitting that such a word should be spoken by one who is not a member of the Toronto Centre nor a graduate of the University of Toronto.

We must give first place to one who has been the inspirer and guide of this Society in its activities through nearly all the 50 years of its history, the creator and the untiring editor of both THE JOURNAL and the *Handbook*, the genial and generous friend of all associated with the Society, Dr. Clarence Augustus Chant. He was the founder and builder in Toronto University, of the excellent department of Astronomy, which holds an entirely unique position in Canada today. To his ability as a lecturer and his skill as an author are due much of the popular interest in astronomy among our people.

[Professor Findlay also recorded his appreciation for the support he had received during his term of office from various officers and members of the General Council of the Astronomical Society. He expressed the hope that they might long continue to serve the Society,

and that worthy successors might be found to extend the work to which they have given such excellent service.—Ed.]

We gladly record our appreciation of the hospitality and generous support afforded the Society by the governing bodies of the University of Toronto. What would the Society have done if it had not had the magnificent accommodation so freely afforded in this its parental home? The University has been unstinted in its services to the scientific and intellectual interests of Toronto and of Ontario. This Society is grateful and proud of its place as a child or protegé of this great benefactor. Special mention should be made of the Department of Physics within the University whose generous co-operation is again in evidence in tonight's programme.

Much credit is due to the Provincial and Dominion Governments for their annual grants in support of the work of the Astronomical Society. Scientific work in astronomy, meteorology, geodesy, and allied branches is largely dependent upon government support. Such work in Toronto may be said to have begun a hundred years ago when the Officers of the British Admiralty made a grant for the establishment of an observatory on the present site of this university. Many of the great observatories of the world are supported and controlled by the governments of the countries where they are located. Two of the big observatories of Canada were built and are maintained by the government of Canada. If the University of Toronto is the mother then the Government is the foster father of this Society, whose financial aid, year by year, makes possible the publishing of the work of our astronomers.

May we now turn our attention to some notes in a survey of the field of the Society's activities? The varied relationships of the Society are portrayed in a classification of the past Presidents now members of its Council. The Meteorological Service of Canada is represented by Sir Frederick Stupart and Mr. Jackson, The Dominion Observatory at Victoria by Dr. Plaskett and Dr. Harper, The Dominion Observatory at Ottawa by the Director Mr. R. M. Stewart and Dr. Ralph DeLury, the Department of Astronomy at the University of Toronto by Dr. Chant and Dr. Young. The allied Departments of Mathematics and of Physics by Professor Alfred DeLury and Professor Gilchrist, the fine group of business men who have been

active leaders in the Toronto Centre are represented by Mr. Miller, Mr. Collins, and Mr. Hunter, and instructors in other universities are represented by Professor Kingston and your retiring president.

This grouping exhibits the various elements in Canada active in extending the science of astronomy and co-operating through the agency of this Society in increasing general interest and promoting its activity. The success of the Society has been obtained and must be maintained and extended by the creative research of the professional astronomers in our observatories, by the enthusiasm and co-operation of men in other walks of life who find recreative values in observation and study, and by instructors who can awaken in the minds of youth an interest in astronomy and a desire to know more of its wonders and achievements.

The activities of the Society are two-fold. Regular meetings are carried on in nine strategically placed centres, in Montreal, Ottawa, Toronto, Hamilton, London, Winnipeg, Edmonton, Vancouver and Victoria. With the exception of the last named these are in University centres. They serve to interest and instruct scattered groups of men and women in the knowledge of astronomy, to maintain and extend the influence of the Society. There is one important university city where I feel sure there is the possibility of a good branch being organized. This is Kingston. We already have a small group of capable members in that vicinity. With the recent removal to Queen's University of one who has proved a strong leader in the Montreal Centre, and who has just been elected as Second Vice-President of the Society there should be an improved possibility of a new Centre there.

In addition to the local meetings there is the important and far reaching service of the Society through its publications. From the last published list I gather that there are in round numbers about 1,000 subscribers to the JOURNAL. Seven hundred of these are members of various centres. About two hundred are members not associated with any centre. And nearly one hundred are subscribers who are not members. Of this total about one hundred and fifty are in the United States and nearly a hundred are in foreign countries. In addition to the thousand subscribers there is an exchange list of a hundred and fifty which indicates about fifty additional places in

foreign countries and fifty in the United States where the JOURNAL is received regularly.

The Society's HANDBOOK is receiving a well deserved and increasing popularity. Last year the issue was increased to 2,500 copies and the demand exhausted the supply well before the end of the year. Three thousand copies of the 1940 *Handbook* have been printed.

In this connection one fact comes out that should be noted. Although the Royal Astronomical Society of Canada is well connected elsewhere both in and outside of the Dominion, we have almost no contact with the three Maritime Provinces. Not only have we no Centre east of Montreal but in all the Atlantic area we have only four members, three in New Brunswick, one in Nova Scotia, none in Prince Edward Island. There surely must be many in these three eastern provinces who are, or would be interested in the wonders of astronomy. What is needed is the discovery and enlistment of some capable leaders, men like Mr. Miller who did so much for the development of the Toronto Centre, and Rev. Mr. Marsh whose enthusiasm and unstinted service were so largely responsible for the Hamilton Centre. Have any of us here contacts in Nova Scotia or New Brunswick that we could use? Perhaps some who travel may be able to do a little missionary work in this, our far east, when visiting there.

I have also been interested in making a little survey of the teaching of astronomy in our universities and colleges and the results came as somewhat of a surprise to me.

The earliest known institutions of scientific research were the astronomical observatories of China, Mesopotamia, and Egypt. Religion, literature and philosophy, as well as Physical Science are all intimately related and richly indebted to Astronomy. The most inspiring discoveries of the human mind in recent years are perhaps those in the microcosm of the new atomic theory and the macrocosm of the new stellar universes. Surely then some knowledge of astronomy should be provided for in every educational programme.

And yet we find, if I mistake not, that in over ten of our universities and colleges there is no course offered in astronomy. In three universities only one course is given. In three of the universities two courses are given, while two of the university calendars list three courses.

The University of Toronto alone of all the Canadian universities has a well developed Department of Astronomy. In addition to courses in the Faculty of Applied Science, there are courses in Arts open to students of pass or general courses, several honour courses provided for more advanced students specializing in Astronomy, and courses in the Graduate School available to students proceeding to higher degrees.

We have abundant testimony from graduates of the interest and value in a general cultural undergraduate course in astronomy. It may be sufficient that one University offers good opportunities for a student to do advanced work in astronomy in his university courses, but we would hope that the day may come when every university will offer at least one optional course in descriptive astronomy.

McMaster University,
Hamilton, Ontario.

PHOTOGRAPHING THE RECENT GROUPING OF THE PLANETS

By Peter M. Millman

(With Plates IV and V)

IT has recently been our privilege to witness a most unusual and interesting grouping of six major planets in the western evening sky. Though this planetary array was chiefly of popular interest and had no particular scientific significance, it happens so rarely that I thought it would be worth while to secure some photographs of the phenomenon.

The camera used was a Kodak Pupille, with the F/2.0 Schneider Xenon lens of focal length 45 mm. This camera combines the advantages of a fairly wide field, 38 by 48 degrees approximately, with an aperture of nearly an inch and a very fast aperture ratio, making it possible to secure faint star trails when the camera is kept stationary. Eastman Super XX Pan film developed in Refract-O-Grain developer was used throughout.

Plate IV was secured at 7.38 p.m. E.S.T. on February 20, 1940, exposure time one minute, camera stationary. Venus and Jupiter are shown very shortly after their close conjunction which took place at 5 p.m. the same evening. Above them and to the left can be seen Saturn and Mars, and near the top of the plate is the constellation Aries. In the foreground appears the north dome of the Administration Building of the David Dunlap Observatory. The photography of the building was greatly facilitated by the bright moonlight and the snow covered ground.

Plate V was taken on the evening of March 1, 1940, just before Mercury disappeared below the horizon. The exposure was thirteen minutes, from 7.20 p.m. to 7.43 p.m. E.S.T. and is the longest exposure that was practical without having undue sky fog on the plate. The camera was mounted on the 19-inch telescope of the Dunlap Observatory for this exposure and the resulting photograph clearly shows all six major planets. Starting from the lower right corner, which is just at the horizon, they are—Mercury, Jupiter, Venus,

Saturn, Mars, and Uranus. Note how Venus and Mars have moved up with respect to Jupiter and Saturn in the interval between February 20 and March 1. Aries again appears near the top of the plate. The faintest star images visible on the original negative are a little fainter than ninth magnitude. Since the lens was used at full aperture the bright images near the edge of the field show considerable coma.

The two photographs reproduced here well demonstrate the interesting results that can be obtained in astronomical photography with the modern miniature camera.

David Dunlap Observatory,
Richmond Hill, Ont.

BY THE LIGHT OF THE MOON*

By H. Boyd Brydon

THERE is an old saying "In the dark, all cats are grey." It is only partly true, for in darkness, real darkness, complete absence of light, the cats would be invisible. Excepting such self-luminous bodies as stars and glow worms we see things only when they reflect light.

Light sometimes seems to play strange tricks and tonight we are going to discuss some of them. As we proceed I shall assume that something I have said is not quite clear and someone has asked me a question about it. Firstly, because as these questions came into my own mind as I was preparing this talk I thought that they might perhaps occur to you also and secondly because they might suggest to you other questions. Eddington has said "I sometimes think that the progress of knowledge is to be measured not by the questions that it has answered but by the questions it provokes us to ask."

Now I do not expect to be able to answer all the questions you may be provoked into asking but I will do my best if you will address me in care of this station. I know well how difficult it is to put into words sometimes exactly what one wants to say; nevertheless, ask them. It is only to those that seek that nature, and, I am afraid, sometimes lecturers also, make themselves clear, and it is worth remembering that all the knowledge we possess has been gained by asking questions, most of which we did not know how to ask.

Let us suppose that looking eastward on one of our lovely evenings, we see the edge of the full moon just rising as it were out of the darkening sea. While we watch the beautiful spectacle the whole disc becomes visible: but it is far from being the silvery moon of which the poets sing.

It is much larger;

It is not round but, except for a sprig of holly, shaped more like the picture of a plum pudding on a Christmas card, round on the top but flat or nearly flat on the bottom; and,

It is copper coloured instead of silvery.

*A radio talk over Station CFCT, Victoria, B.C., October 24, 1939.

Why does it look so different?

By the way, the Sun goes through much the same changes at rising and setting and from the same cause, so that by answering these questions we shall be killing two birds with one stone.

First question then: Why is the moon larger when it is rising or setting than when it is high in the sky?

Answer: "It isn't larger."

"Nonsense," says someone, "I can see it's larger, much larger." Still, the answer is "No, it isn't." In fact it is a little smaller because it is some 4,000 miles farther away. I grant you that it *looks* larger but that is because our eyes deceive us. If our eyes were not at fault, the moon would have to be two sizes at once, for when the moon is just rising and looks so large to us, to the people living back east it is riding high in the sky and looks its normal size.

But we can easily settle the matter by a little experiment. An experiment, you know, is our way of putting a question to nature. We do something to something else and what happens is nature's answer. Sometimes her answers are hard to understand, sometimes indeed they appear even to contradict one another, but that is because we do not as yet know what they mean.

Now for our experiment. Please do it yourself. You will find it far more interesting and convincing than simply taking my word for it. Roll up a sheet of letter paper into a small tube about ⅜-in. in diameter and look through it with one eye at the rising moon while you look directly at the moon with the other eye. The moon as seen through the tube will be much smaller than she appears to the other eye. Try it.

Our eyes lead us astray also when we estimate the altitude of a star. Low stars always look higher than they really are. What is the reason? Many explanations have been offered but the truth is, we don't know. In his Manual of Meteorology, a standard work, Napier Shaw says, "Whether these imperfect estimates are due to some psychological or physiological influence common in humanity is a question to which no satisfactory answer can be given." In other words, "It's so, but we don't know why it's so." This is true of many other things as well.

Next question: Why is the rising moon shaped like a Christmas pudding, round on the top and nearly flat on the bottom?

Answer: Because the moon is not where you see it, it is actually down below the horizon.

Another simple experiment will help to make this statement clear. Set a small bowl on the table, drop a penny into it and back away from the bowl until its rim hides the penny. Then get someone to fill the bowl with water and presto! you can see your penny again. I may tell you ladies and gentlemen that this part of the experiment is always very reassuring to us Scotsmen. Notice also that when the bowl has water in it, it looks much shallower; the bottom appears to be lifted up bringing the penny along with it. What happens is that the rays of light suddenly bend in passing out of the water into the air.

You can prove that the bending takes place only at the surface of the water by noting where a straight wire such as a knitting needle appears bent when you rest it in the bowl.

We are accustomed to think of a *ray* of light as if it were a sort of rigid stick of light. But the word means really the path along which the light is travelling and when we speak of a ray of light being *bent* we really mean that the path has changed its direction. The light is then said to be *refracted*. The word comes from the Latin and means "to break back."

Our little experiment then shows us that changing the medium in the bowl from air to water caused the light to be refracted, to change its direction so that we could see down over the rim of the bowl, round the corner so to speak. Why?

The reason is that although light is nature's speediest traveller, its speed is not the same in all substances. For instance, in air light travels about 186,000 miles in a second, a little faster in thin air and a little slower in dense air, but fast enough to circle the equator 7½ times while I say "Ready?—go!" In water, light moves more slowly, about 140,000 miles and in glass more slowly still, only about 120,000 miles in a second.

Please do not think that these differences in the speed of light, even the little difference between its speed in dense air and in thin

air, are of no consequence. On the contrary, their importance to us cannot be overstressed.

If the speed of light were the same in all substances Galileo could not have made the little telescope with which he discovered the four largest moons of Jupiter and watched them revolving round the planet as you can do today with a good field-glass. He could not have seen Venus pass through the same phases as does our moon, from new to full and back again to new. These two discoveries disproved the belief, unchallenged for 1,500 years, that the earth rested in the centre of the universe and that the sun and all the other celestial bodies revolved round it. Without this change of pace there could have been no field glasses, no spectacles to aid defective vision, no microscopes. Discoveries vital to the well-being of the human race could not have been made. We could never see a rainbow. Indeed we would be quite unable to distinguish anything.

"I can see that the speed of light may be different in different substances" says my friend, "but what has that to do with changing its direction as it passes from one substance into another?"

I think that the best way to make that clear is by describing a sort of working model of it. It may sound a little bit complicated over the radio but really it is not. If you will try it after this broadcast I think you will see clearly why the change in direction takes place and in a way that is easy to remember and easy to show to your friends. We shall need a large sheet of paper and about a dozen pennies. Lay the paper smoothly on a table and on it draw four straight lines: no. 1, right across the middle of the sheet and no. 2 parallel to no. 1 and about 8 or 9 inches on the far side of it from you. The space between these two lines is to represent water. All the paper outside of this space represents air. Now we want to represent our light. On your side of line no. 1, and a few inches away from it draw line no. 3, parallel to line no. 1, and line no. 4 inclined at about 30° to line no. 1, with the right hand end nearest to no. 1. These lines nos. 3 and 4 are to represent the fronts of two separate and distinct beams of light moving (in one case perpendicularly, and in the other obliquely) from the air through the water and out into the air again.

Having set the stage we are ready for the actors. These are the pennies. They are to represent the little bits of light which form the

moving front of the beam of light. We can represent the different speeds of the light in the air and in the water by moving the pennies say one inch at a time while they are in the air and three-quarters of an inch at a time while they are in the water.

Now for the first act. Place the pennies on line no. 3 with their edges touching and move them forward through the air at right angles to line no. 3 and at the proper speed. Notice first that they all cross the air-water line at right angles; second, that they all cross it at the same time; third, that they travel slower through the water but still in the same direction; fourth, that they do not get separated, they keep touch all through the act; fifth, that they all cross the water-air line no. 2 at the same time, and sixth, that when they are across it they travel at the original speed and direction.

Second act. Place the pennies on the oblique line no. 4, and again move them forward at right angles to it and at the proper speed. Notice in this case that they cross the air-water line obliquely. What are the consequences? Two things. Let us consider first the penny on that end of the line nearest the water. Watch it carefully, for what happens to this penny happens to all of them in turn and explains our reappearing penny trick. First, as its right edge reaches the water ahead of its left edge, its right edge being in the water is slowed up while its left edge continues to travel at its original speed which causes the penny to swing around towards its right. When the whole penny is in the water then it is not only travelling slower but in a different direction. The same thing happens to the next penny, then to the next and so on so that when the line of pennies is partly in air and partly in water there is an abrupt bend in it at the air-water surface just as appeared in the knitting needle in our experiment.

Notice second, that while penny no. 1 being in the water is travelling in the new direction, the pennies farther down the line to the left are still in air, travelling in the original direction and consequently, note this carefully, are moving farther away from penny no. 1. The result, as you will see if you move the pennies correctly, is that while travelling through the water the pennies are no longer touching each other but have become separated a little.

The effect then of this oblique crossing of the air-water surface is first to change the direction of the beam of light and secondly to widen it. The beam has been refracted and caused to diverge. If the

motion be continued on across the water-air surface, line no. 2, the beam will be found to be moving through the air parallel to its original direction but displaced sideways therefrom and its several particles will be in touch again.

"Wait a moment" says someone, "it's not clear yet. Your illustration shows why light is refracted in passing out of one medium into another, but the light from the moon doesn't do that; it passes through air only which is not the same thing at all." The same explanation applies however. Remember that light moves more slowly through dense air than through rare air. As the air is densest at the surface of the earth, the light from the moon, although it comes from below the horizon and so enters our atmosphere in a slightly upward direction, is bent more and more downwards as it passes obliquely into denser and denser air. Now no matter where an object actually is, it can only appear to us to be in the direction from which its light enters our eyes. As the light from the rising moon finally reaches our eyes from above the horizon that is where the moon appears to us to be. The refraction, the bending of the rays of light caused by passing from rare air into dense air, enables us to see down over the rim of the horizon just as it enabled us to see down over the rim of the bowl in our reappearing penny experiment.

Distortion of the moon's outline in question 2 from a circle into a plum pudding shape is also due to refraction. The light from the bottom edge of the moon comes through denser air than the light from the top edge and consequently is refracted more, so that the bottom edge is lifted up more than the top edge.

You can imitate the effect by a slight modification of our penny and bowl experiment. Put a little water in a plate and stand a penny on edge in it. The dry part of the penny being seen only through air is not distorted but the light from the under water part is refracted in passing out of the water into the air and the wet part of the penny appears lifted upwards. Try it.

The third question: "Why is the moon so red when it is close to the horizon?" can be answered in a few words but the explanation must be left until next week. The answer is "For the same reason that the sky is blue."

Victoria, B.C.

THE HUME CRONYN MEMORIAL OBSERVATORY

By H. R. KINGSTON

LAST year the University of Western Ontario was very fortunate in being the recipient of a generous gift of an observatory and telescope from Mrs. Frances Amelia Cronyn, in memory of her husband, the late Hume Cronyn. While a member of the Federal Government during the Great War, Mr. Cronyn pressed upon the government the need of federal aid for research, and it was through his untiring efforts on behalf of this project that the National Research Council of Canada was formed. The wisdom of this step has since been proven over and over again by the problems that have been attacked and solved by this institution, with subsequent benefits of inestimable value to Canada. On Mr. Cronyn's death, his family decided to establish a memorial to his life and work, and last spring consideration was given to the project of having this memorial take the form of an observatory. In due course Mrs. Cronyn approved the idea, and gave to the University of Western Ontario the sum of $40,000 to erect the building and purchase a telescope. The building will be called the Hume Cronyn Memorial Observatory.

The purpose of the gift is to aid in the teaching of Astronomy in the University, to encourage the work of the London Centre of the Royal Astronomical Society of Canada, and, in general, to stimulate in the public mind an interest in Astronomy. Further, it is planned to use the equipment in a modest program of research, in collaboration with other observatories, in fields where instruments of this size can do effective work. It is hoped also that the work of the observatory will inspire some students to pursue astronomical research in some of our great observatories with their large and powerful equipment.

In December the contract for the building was awarded to the Putherbough Construction Company Ltd. of London, and the construction of the telescope was placed in the hands of the Perkin-Elmer Corporation of New York.

The observatory building is 31 feet by 45 feet in size, and is constructed of Credit Valley limestone, trimmed with Indiana sand-

stone, and is now (March) fast taking shape. The first floor contains the foyer, beyond which is an office and library. In the foyer will be suspended a Foucault pendulum, and also there will be on display here the Dresden meteorite, which the University was fortunate in securing last fall through a gift from the directors of the London Life Assurance Company. The walls of the foyer will contain panels of astronomical transparencies. The basement, which is practically at grade level at the rear of the observatory, contains a lecture room capable of seating about eighty persons. A workshop and a small kitchenette have also been included here. On the second floor is the

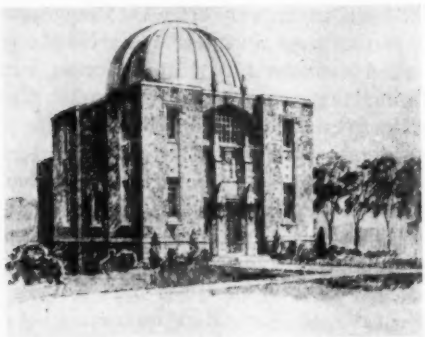


FIGURE 1.—Hume Cronyn Memorial Observatory.

observing room, which extends four feet beyond the eighteen foot circle of the dome, giving adequate space for observers to move about beyond the sweep of the telescope. One corner of this room is occupied by the dark room. Above the office and library is an observation roof for constellation study and mapping. A stair leads from this to the roof of the observing room around the dome, where further observation space is available. The dome is constructed of copper over a steel framework. It is hoped that the building and telescope will be ready for use in the Summer School in July.

The telescope is a ten-inch refractor with three-inch finder and synchronous motor drive. The auxiliary equipment includes ten eyepieces, zenith prism diagonal, solar wedge diagonal, ocular spec-

troscope, sun and moon glasses and dew cap. The telescope will carry a Schmidt camera with a twelve-inch mirror and eight-inch correcting plate. The pier of the telescope rests on two beams

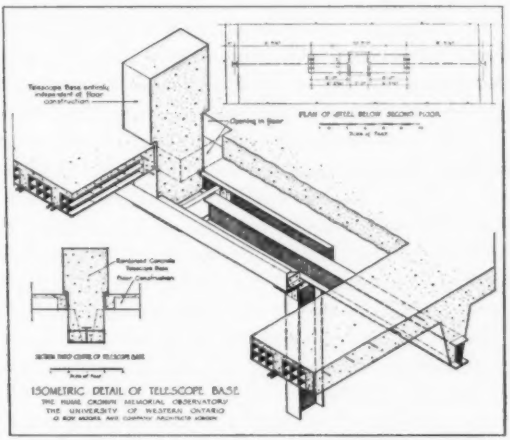


FIGURE 2.—Detail of Telescope Base.

separate from those supporting the floor, as indicated in the figure, and carried by two pillars. Thus any vibration of the floor cannot be transmitted directly to the telescope.

The observatory is situated on one of the highest points of the campus, and will be a substantial and pleasing addition to the beautiful group of buildings which now grace the grounds of the University of Western Ontario.

University of Western Ontario,
London, Ontario.
March 8, 1940.

MINUTES OF THE ANNUAL MEETING OF THE ROYAL ASTRONOMICAL SOCIETY OF CANADA

The annual general meeting was held in the McLennan Laboratory of the University of Toronto on Tuesday, January 16, 1940, at 8.00 p.m. Dr. William Findlay, the President, occupied the chair.

The minutes of the annual meeting of 1939 were approved as published in the JOURNAL, March, 1939, and were adopted as read.

The report of the General Secretary was read and accepted. In his report Mr. E. J. A. Kennedy drew attention to plans being made by the Council for observance of the Society's fiftieth anniversary later in the year. There was a steadily increasing demand for the *Observer's Handbook*, especially in Canadian and United States educational institutions, and 3,000 copies of the 1940 edition had been printed, he said. Inasmuch as the widespread popularity of the Society's publications was due in the main to the untiring efforts of Dr. C. A. Chant, editor of both the JOURNAL and the *Handbook* since their inception, the meeting voiced its appreciation of Dr. Chant's endeavours.

Mr. J. H. Horning, General Treasurer, presented the financial statement. Moved by Mr. S. C. Brown, seconded by Mr. Kennedy, that the Treasurer's report be accepted and published in the JOURNAL, together with the financial reports of the various centres.

The report of Dr. P. M. Millman, the Librarian, was read by Miss E. M. Budd, assistant secretary-treasurer, and was accepted on motion of Mr. Horning, seconded by Mr. Duncan.

Mr. R. S. Duncan, the Curator, pointed out that greater use might be made of the collection of lantern slides. The question of accommodating them in the Library was discussed. A recommendation was passed by the meeting and forwarded to Council that consideration should be given to some plan to make the slides more useful to members and the public.

Mr. F. L. Troyer and Miss Budd were appointed as Scrutineers to examine and report on the ballots. The 144 ballots returned were almost unanimously in favour of the names submitted by the nominating committee of Council. Dr. Findlay then declared the Officers and Councillors for 1940, as follows, elected:

Honorary President—The Hon. Leonard J. Simpson, M.D., Minister of Education for the Province of Ontario.

President—J. A. Pearce, M.A., Ph.D., Victoria, B.C.

First Vice-President—F. S. Hogg, Ph.D., Toronto.

Second Vice-President—Miss A. V. Douglas, Ph.D., Kingston.

General Secretary—E. J. A. Kennedy, Toronto.

General Treasurer—J. H. Horning, M.A., Toronto.

Recorder—R. H. Combs, Toronto.

Librarian—P. M. Millman, Ph.D., Toronto.

Curator—R. S. Duncan, Toronto.

Council—D. S. Ainslie, M.A., Ph.D., Toronto; Major E. H. Anundson, London, Ont.; D. W. Best, D.D., Toronto; H. Boyd Brydon, Victoria; J. W. Campbell, M.A., Ph.D., Edmonton; Dean Henry F. Hall, Montreal; E. A. Hodgson, M.A., Ph.D., Ottawa; J. A. Marsh, M.P., Hamilton, Ont.; A. Thomson, M.A., Toronto; L. A. H. Warren, M.A., Ph.D., Winnipeg.

Moved by Mr. Troyer, seconded by Mr. Brown, that the auditors, Messrs. A. R. Hassard and Andrew Thomson, be thanked for their services in auditing the books of the Society for 1939 and be re-appointed for 1940.

Moved by Mr. Brown, seconded by Mr. Troyer, that the Officers and Council for 1939 be thanked for their services. Special appreciation was expressed for the work of Dr. Findlay who as Vice-President and President in recent years had come to Toronto to attend every General Meeting and meeting of Council during his term of office.

The meeting then adjourned.

FREDERIC L. TROYER, *Acting Recorder.*

REPORT OF THE GENERAL SECRETARY

The membership of the SOCIETY shows a slight increase during 1939. It is only fair, however, to observe that the added members are in the section named members at large, residents for the most part outside of Canada. While the interest in the Science is increasing year by year yet it would be gratifying to learn of the Centres making a determined effort to bring before the public the

great advantages and enjoyment to be gained by a membership in our society.

Special mention should be made of the publications of the Society. The demand for our valuable *Handbook* is increasing each year. Although 2500 were printed in 1939, the number was not sufficient to supply the demand; three thousand have been printed for 1940.

It cannot be emphasized too greatly that the success of our publications is due to the untiring efforts of the editors. Dr. C. A. Chant has been the editor-in-chief since its inception—nearly 40 years and the thanks of the Society are due to him for this presentable appearance and the very creditable contribution to the literature of the science. Dr. F. S. Hogg has now for the last few years taken over part of the burden of the active editorship and is carrying forward the work with singular ability. Few of the membership realize the immense amount of work entailed in the publication of the JOURNAL and *Handbook*. The many hours the editors spend *are* given gratis. In the preparation of the *Handbook* the figures and tables are carefully worked out and supplied by members of the staff of the David Dunlap Observatory.

A number of important meetings have been held by the Council. Of special interest at this time are the forthcoming events in connection with the celebration of our semi-centennial year. It is just 50 years since the founding of our Society. A committee has been appointed and a programme of interesting meetings is being arranged to be held in September, probably at Exhibition time. A paper on the early history of the Society will be presented by Dr. Chant at this time.

Correspondence at the office of the Society is growing. Numerous requests are reaching us to provide information about suitable literature for beginners and instructions for amateur telescope making. Reprints of special articles from the JOURNAL are also in greater demand.

E. A. KENNEDY,
General Secretary.

MEMBERSHIP OF THE SOCIETY

The Membership of the Society on December 30, 1939, as shown by the Reports of the various Centres, was as follows:

	1938	1939
Toronto	189	188
Ottawa	56	58
Victoria	111	114
Montreal	125	115
Winnipeg	48	38
London	41	47
Hamilton	51	54
Vancouver	32	32
Edmonton	44	43
Members at Large	197	213
Life Members not in Centres	12	12
	908	914
Additional Subscribers to JOURNAL	70	78

REPORT OF THE LIBRARIAN

I should like to remind the members of our Society again that those living outside the Toronto district may borrow books from the library by mail, the only stipulation being that the member borrowing books in this way pay the carrying charges in both directions. The Society has a large number of monographs on general astronomy and lists of books available on any specialized subject will be sent to any member on request. The library hours at 198 College St., Toronto, are as follows:

Monday and Tuesday	10-12 a.m.	2-5 p.m.
Wednesday and Friday	2- 5 p.m.	
Thursday	2- 5 p.m.	7-9 p.m.
Saturday	9-12 a.m.	

During 1939 the following periodicals were received:

Canada and the Empire	130
The United States	223
Other Countries	190
Total	543

All periodicals of popular interest may be referred to at 198 College St. These include *Popular Astronomy, The Telescope, The Sky, Monthly Evening Sky Map, Journal of the B.A.A., Southern Stars, L'Astronomic,* etc. The Harvard Announcement Cards are also available for reference at Headquarters. These give news of any recent discoveries of comets, novae, and other items of particular interest to the observer. The definitely technical periodicals are housed at the Dunlap Observatory in Richmond Hill.

We acknowledge with thanks the presentation to the library of the following books:

Presented by Mr. B. J. Topham:
"The Prediction and Reduction of Occultations",
supplement to the Nautical Almanac for 1939.
Presented by Remeis Sternwarte:
"Die Altesten Räderuhren und Modernen Sonnenuhren",
by von Ernst Zinner, Bamberg.
Presented by the publishers, Longmans, Green and Co.:
"The Pageant of the Heavens", by F. Warren Grover, 1937.
Presented by Mrs. Leon Barritt:
"Barritt's Revised Celestial Album",
edited and compiled by Maria Barritt, 1939.

During 1939 the library has secured the following books through purchase:

"The Observational Approach to Cosmology",
by Edwin Hubble, 1937.
"The Stars Night by Night", by Joseph H. Elgie, 1919.
"The Glass Giant of Palomar", by D. O. Woodbury, 1939.

The Librarian always welcomes the suggestion of any new books which members consider suitable for the library.

PETER M. MILLMAN, *Librarian,*

REPORTS OF THE SECRETARIES OF THE CENTRES

TORONTO CENTRE

Membership as of December 31st, 1939:

Resident in Toronto	140
Life Members	8
Non-resident Members	40

There were 16 new members elected and 15 removed from the rolls for various reasons, leaving a net gain of one.

There were twelve regular meetings held during the year. Mr. A. F. Bunker gave an interesting talk on the "Star Legends of the American Indians", Miss Elizabeth J. Allin again carried off a brilliant lecture in her "Recent Advances in Nuclear Physics", and Dr. Hewson's lecture "Recent Investigations of the Aurora" was of special interest during this period of maximum sun spots. The Society welcomed Professor Dean B. McLaughlin of Ann Arbor, Michigan, and thoroughly enjoyed his talk on "Exploding Stars". Mr. R. H. Combs, Dr. D. W. Best, and Mr. J. R. Collins, of our own Centre, gave us three very interesting evenings. Special mention must be made of our visit to the David Dunlap Observatory this year. Not only is the Society indebted to Dr. R. K. Young for the invitation, but also for the privilege of examining his latest scientific apparatus. Professor A. E. Johns of McMaster University, gave us a talk on "This Runaway Universe". The popularity of Professor Johns and his subject was evinced by the exceptionally large number attending.

Dr. Peter M. Millman had charge of the "Special Course of Lectures", during the first half of the year, and Professor F. S. Hogg during the second half. The increased attendance was largely due to the popularity of the instructors and their lectures.

F. L. Harvey, *Secretary.*

Ottawa Centre

Meetings: There were three open meetings of the Ottawa Centre of the R.A.S.C. as follows:

February 9, 1939—The 200-Inch Telescope, by R. M. Motherwell, M.A., of the Dominion Observatory.

March 15, 1939—Exploring Space, by John A. Marsh, M.P., for Hamilton West.

March 29, 1939—Current Research at the David Dunlap Observatory, by J. F. Heard, Ph.D.

In addition there were three business meetings and one luncheon meeting of the Council.

Membership: At the beginning of the year, the membership stood at 56. During the year six new members have been added to the Society, and one was transferred to Ottawa from Toronto, a total gain to the Centre of seven. Against this were three resignations, one member dropped, and one member lost by death, resulting in a net gain for the year of two. Membership at the end of the year stands at 58.

Observations: Meteor observations both visual and photographic were planned for the Perseid, Orionid and Leonid showers. In this programme five members and sixteen non-members, most of whom were high school people, participated. Two members reported Auroral Observations.

Amateur Construction of Telescopes is reported by three members and a fourth reports the construction of a motor driven piece of apparatus which demonstrates the motions of the planets about the sun.

Correspondence: The usual notices to members concerning meetings and the correspondence in connections with arrangements for these meetings were sent out. One News Letter concerning the planet Mars was sent to the membership and the press in July.

As in the past, and through the courtesy of the Dominion Astronomer, Mr. R. Meldrum Stewart, the Saturday Evening Programme Bulletin of the Dominion Observatory was sent to all members.

MALCOLM M. THOMSON, *Secretary.*

LONDON CENTRE

During the year 1939 the London Centre held nine regular monthly meetings with a total attendance of 317. In addition, six special public meetings were conducted, with a total approximate attendance of 4,000. A summary of these meetings follows:

January 13—Attendance 69.

Observation Study—conducted by Dr. W. G. Hofferd.

Observer's Handbook Study—Rev. W. G. Colgrove.

A Comparison of Mean Solar and Sidereal Units of Time—Dr. G. R. Magee.

Motion Pictures.

February 10—Attendance 30.
Observer's Handbook Study—conducted by Dr. H. R. Kingston.
Lecture—Nebulae, by Mr. J. Higgins.

March 10—Attendance 31.
Observer's Handbook Study—conducted by Dr. H. R. Kingston.
Lecture—The Nature of Light, by Dr. R. C. Dearle.

April 14—Attendance 19.
Lecture—Sunspots and their Effects on Human Affairs, by Dr. G. R. Magee.

May 12—Attendance 45.
Observation Meeting—directed by Rev. W. G. Colgrove.

June 3—Attendance 20.
Annual Picnic, in conjunction with Federation of Ontario Naturalists.

July 7—Attendance 150.
Special Public Meeting—motion pictures.

July 21—Attendance 400.
Special Public Meeting—observation through telescopes, constellation study, display of meteoric fragments.

July 27—Attendance 3,000.
Special Public Meeting—telescopic observations of Mars, Jupiter, and the Moon.

August 23—Attendance 300.
Special Public Meeting—telescopic observation of Mars, Jupiter, Saturn, and the Moon.

September 21—Attendance 200.
Special Meeting at Byron Sanatorium—observations through telescopes.

September 26—Attendance 70.
Special Public Meeting—display of the Dresden meteorite.

October 13—Attendance 43.
Lecture—Meteorites, by Professor G. H. Reavely.
Display of meteorite material.

November 10—Attendance 30.
Lecture—Storms and Storm Fore-Casting, by Dr. E. G. Pleva.

December 8—
Annual Meeting.

The paid-up membership at this date is 47—one new member having sent his fee directly to Toronto, where it is credited to the London Centre. This membership figure represents an increase of six over that of the previous year. Mr. William Wright, a member of long standing, passed away during the summer.

The Secretary wishes to record the valuable services rendered at the Special Public Meetings by Mr. T. C. Benson, Mr. M. O. Culbert, Mr. E. E. O'Connor, Mr. O. Kilburn, Mr. E. H. McKone, Rev. M. E. Conron, Mr. Boam, Mr. Gallagher, Prof. H. Reavely, Prof. E. Pleva, Prof. H. R. Kingston, Rev. W. G. Colgrove and Prof. G. R. Magee. The London Centre is deeply indebted to Mr. Freeman of the staff of the *London Free Press*. The success of the Special Public Meetings is due largely to his enthusiasm and to his cheerful co-operation in arranging the proper newspaper publicity.

The Meteor Observing Group, under the direction of Mr. J. Middlebrook, observed the meagre Perseid Shower of last August.

G. R. MAGEE, *Secretary-Treasurer.*

VICTORIA CENTRE

Membership: At the beginning of the year, the membership list contained 111 names, there being 2 life members, 95 ordinary members and 14 junior members. During the year members were lost for the following reasons: deceased 3; resigned 7; dropped for non-payment of dues 6, a total of 16. In the same period of time we have enrolled 19 new members. Thus our net gain in membership is 3 and our total membership now stands at 114. The effective gain, when we consider the increased interest and vigor of the new members is considerably greater than that indicated by these figures.

Meetings: During the fiscal year 1939 there have been held 10 regular meetings. The first of these was our initial Society dinner held on December 7, 1938. After brief annual reports of the activities of the Victoria Centre and a few musical numbers, the after-dinner speech was presented by Dr. J. A. Pearce. He related, most interestingly, the early history of the Royal Astronomical Society of Canada. This function was considered so successful that it is planned to make it an annual affair. In the remaining 9 meetings, the lectures covered a variety of topics including, as well as Astronomy, the allied subjects of Meteorology, Physics and the History of Science. The addresses have been of a uniformly high order of excellence.

There have been held also 5 meetings of the Council of the Victoria Centre. These, as usual, have been occupied with the business

of preparing programmes, carrying on the business of the Society and otherwise furthering the aims which justify the Society's existence.

The Summer Session: The summer session sponsored by the Centre was this year perhaps the most successful yet held. Its registration, 56, was the greatest to date, the attendance at the meetings averaged considerably more than this number, and the 6 lectures were well presented and well received. One feature of the course was the preparation by Mr. K. O. Wright of diagrams of "catch-figures" of a number of summer constellations upon which members of the course made eye estimates of relative brightnesses of the stars indicated.

One novel programme started this summer was the making available for the use of the general public, the telescopes of several of the Society members. The telescopes were set up at Beacon Hill Park on a few summer evenings and those interested, some hundreds of people, were enabled to view Mars and other suitably situated objects. The scheme was conceived by Dr. J. A. Pearce and partly sponsored and supported by the Victoria Chamber of Commerce and Publicity Bureau. It was initiated because of general public interest in the close approach of Mars to the earth this past summer. So encouraging was the public response to the invitation to use the telescopes that the possibility of repeating and extending the programme next summer will be seriously considered this spring.

Radio Programmes: Early in the summer, several quarter-hour radio programmes were given by members of the Council of this Centre, mainly to acquaint the public with the forthcoming summer course. The talks were apparently so well received that Station CFCT invited the Society to sponsor such a 15-minute programme each Tuesday evening at 7.30 p.m. Such a series called "Evenings with the Stars" has thus been carried on from early in July until the present. The speakers, treating various phases of astronomy, have been some dozen members of the Victoria Centre, R.A.S.C. It is planned to continue "Evenings with the Stars" after a brief Christmas recess.

ANDREW MCKELLAR, *Secretary.*

Hamilton Centre

The Centre has held its usual quota of nine regular meetings in addition to a meeting held in June when Dr. J. A. Pearce made a trip east from Victoria, as well as two Council meetings.

January 5—Mr. F. H. Butcher, B.A.: Greek Myth in the Heavens.
February 1—Mr. Wm. D. Stewart: The Telescope and an Outline History of Astronomy.
March 2—Mr. J. R. Gibbs: What We Know About Mars.
April 6—Dr. F. S. Hogg: Several Great Observatories.
May 4—Mr. W. S. Mallory: Gravitation.
June 20—Dr. J. A. Pearce: Recent Astrophysical Researches at Victoria.
September 18—Field night at the residence of Walter T. Goddard.
October 5—Refreshments supplied by the wives of the executive. A Dramatization of Relativity dialogue was given by Messrs. Butcher and Mallory while a game of Questions and Answers was put on by Mr. Broadhead, assisted by Mr. Stewart.
November 2—Mr. Norman Green: Let's Make Believe.
December 7—Annual Meeting.
John A. Marsh, M.P.: Hither and Yon in the Heavens.

The meetings of 1939 were a duplication of the success of the previous year under the continued presidency of Mr. George E. Campbell. The main talk of the evening was usually preceded by questions and answers or by a short discourse by one of the Council on some interesting phase of astronomy.

The enrolment of the Centre is now 54.

H. B. Fox, *Secretary*.

Edmonton Centre

There were seven regular meetings during the year, apart from the annual dinner meeting. The Council met twice.

The principal speakers were as follows:

December 8, 1938—(Dinner meeting) Mr. C. S. Burgess: Astronomy and Human Thought.
January 12—Mr. M. J. Hilton: Eclipses.
February 9—Dr. A. J. Cook: Astronomy for the Millions.
March 9—Dr. J. A. Allan: Meteorites.
April 13—Dr. J. W. Campbell: Graphical Prediction of Eclipses.
May 11—Mr. A. Gibb: Mars.

October 19—Mr. H. B. Doughty: Sundials.
November 16—Dr. E. H. Gowan: A South-west Summer.
December 14—(Dinner meeting) Dr. S. W. Dyde: Shakespeare and the Stars.

The annual picnic was held on Saturday, September 23rd, and the dozen or so members who turned out enjoyed good seeing through Mr. Wates's telescope.

The number of members is now 43, including 5 associates. These receive the *Handbook* but not the JOURNAL. We have lost one member by death and three by resignation. Four others drop out by being one year in arrears with their dues. Five new members have been elected during the year, and one, elected as a member-at-large, has been attached to the Centre. In addition, three new associate members were elected.

Several additions to the library of the Centre have been made by purchase and gift. The constitution of the Centre is now being amended to include a Librarian as an additional officer. The subscription to the popular periodical "The Sky" has been continued.

E. S. KEEPING, *Honorary Secretary.*

FINANCIAL STATEMENT, 1939

I. GENERAL TREASURER

GENERAL ACCOUNT No. 4359

Receipts		Disbursements	
Balance from 1938	$1,168.70	Publications	$2,439.53
($157.97 belongs to Southam Press Fund)		Public Meetings	67.76
Grants received	2,270.00	Library	87.96
Fees	1,342.00	Stamps and Stationery	295.89
Publications	553.33	Salary, Asst. Sec.-Treas.	780.00
Interest	103.72	Grants to Centres	575.00
Stamps (Toronto Centre)	33.56	Rent	120.00
		Janitor	18.00
		Bank Charge	4.00
		Miscellaneous	4.00
		Balance to 1940	1,079.17
		(234.84 belongs to Southam Press Fund)	
Totals	$5,471.31		$5,471.31

LIFE MEMBERS' ACCOUNT No. 4390

Receipts		Disbursements	
Balance from 1938	$169.30	Nil	$ 0.00
Bank Interest	.91	Balance to 1940	170.21
Totals	$170.21		$170.21

BUILDING FUND ACCOUNT No. 4383

Receipts		Disbursements	
Bank Balance from 1938	$494.85	Nil	$ 0.00
Bank Interest	2.80		
Bond Interest	192.50	Bank Balance to 1940	690.15
Totals	$690.15		$690.15

SOUTHAM PRESS FUND

(Deposited in General Account No. 4359)

Receipts		Disbursements	
Balance from 1938	$157.97	Nil	$ 0.00
Bank Interest	2.37		
Bond Interest	74.50	Cash Balance to 1940	234.84
Totals	$234.84		$234.84

SUMMARY OF BONDS HELD BY THE ROYAL ASTRONOMICAL SOCIETY OF CANADA

Account	Face Value of Bonds		Yearly Interest
Life Members'	$ 500.00	.....	$ 20.50
Building Fund	5,000.00	.....	192.50
Southam Press Fund	1,700.00	.....	74.50
Totals	$7,200.00		$287.50

Audited and found correct, January 10, 1940.

ANDREW THOMSON
A. R. HASSARD } *Auditors.*

(Signed) J. H. HORNING, *General Treasurer, R.A.S.C.*

II. TREASURERS' REPORTS OF CENTRES

TORONTO CENTRE

Receipts		Disbursements	
Balance from previous year	$123.69	Rentals	$ 36.00
149 Members' Fees	298.00	Fees to General Treasurer	298.00
Grant from General Council	149.25	Postage and Stationery	39.06
Bank Interest	.....	Expenses re Meetings	17.10
		Fees and Expenses, Lecturers	86.52
		New Notice Board	10.05
		Printing	22.96
		Caterer, Observatory Meeting	33.50
		Balance carried forward	27.75
Totals	$570.94		$570.94

OTTAWA CENTRE

Receipts		Disbursements	
Balance on hand from 1938 in Royal Bank	$ 97.56	Fees to General Treasurer	$99.00
Members' Fees	109.00	Stamps and Stationery	2.00
Grant from General Council	49.50	Advertising:	
Bank Interest	.16	Newspaper	15.60
		Posters and Cards	16.10
		Museum Attendants	10.00
		Expenses re Films used in Mr. Motherwell's Lecture	4.58
		Expenses of Dr. Heard	20.15
		Balance on Hand	88.79
Totals	$256.22		$256.22

MONTREAL CENTRE

Receipts		Disbursements	
Balance from previous year.	$200.33	Rentals	Nil
Members' Fees (109½)	219.00	Fees to General Treasurer	$219.00
Grant from General Council	90.50	Postage and Stationery	8.60
Bank Interest	5.18	Expenses re Meeting	23.80
		Secretarial Assistance	7.25
		Sundry General Expenses	5.50
		Library, Subscription	2.10
		Balance carried forward	248.76
Totals	$515.01		$515.01

LONDON CENTRE

Receipts		Disbursements	
Balance from previous year.	$ 57.88	Rentals	$38.50
Members' Fees (50*)	100.00	Fees to General Treasurer	92.00
Grant from General Council	44.00	Postage and Stationery	.....
Bank Interest	.34	Expenses re Meeting	26.93
		Secretarial Expenses	41.75
		Balance carried forward	3.04
Totals	$202.22		$202.22

WINNIPEG CENTRE

Receipts		Disbursements	
Balance from previous year.	$23.93	Rentals	$ 6.00
Members' Fees (30)	60.00	Fees to General Treasurer	60.00
Grant from General Council	36.25	Postage and Stationery	7.50
Bank Interest	.52	Expenses re Meeting	19.60
Exchange	.31	Exchange, etc.	.30
		Balance carried forward	27.61
Totals	$121.01		$121.01

*46 Members' Fees for 1939 and 4 for 1940.

VICTORIA CENTRE

Receipts		Disbursements	
Balance from previous year	$ 31.16	Rentals	$ 22.50
Members' Fees (81)	157.00	Fees to General Treasurer	158.00
Grant from General Council	85.50	Postage and Stationery	10.50
Bank Interest	.22	Expenses re Meeting	8.50
Balance from Summer Course	8.48	Printing and Mimeographing	10.20
Grant from Edmonton Centre re Solar Films	1.00	Exchange	.55
		Miscellaneous:	
		Annual Dinner $5.85	
		Subscription to "Sky" 1.75	
		Membership Cards 1.20	
			8.80
		Balance carried forward	64.31
Totals	$283.36		$283.36

HAMILTON CENTRE

Receipts		Disbursements	
Balance from previous year	$ 1.52	Rentals	$22.50
Members' Fees (45½)	91.00	Fees to General Treasurer	86.00
Grant from General Council	49.00	Postage and Stationery	9.46
Bank Interest	.12	Expenses re Meeting	5.75
Field Night Proceeds	16.50	Printing	22.10
Donations	.75	Exchange on Cheque	.15
		Balance carried forward	12.84
Totals	$158.89		$158.89

VANCOUVER CENTRE

Receipts		Disbursements	
Balance from previous year	.....	Balance (deficiency) from 1938	$ 4.45
Members' Fees	$58.00	Rentals	Nil
Grant from General Council	24.50	Fees to General Treasurer	58.00
Bank Interest	.35	Postage and Stationery	7.21
	$82.85	Expenses re Meeting	14.80
Deficiency (carried to 1940)	7.55	Programmes	5.94
Totals	$90.40		$90.40

EDMONTON CENTRE

Receipts		Disbursements	
Balance from previous year.	$27.17	Rentals.....	$ 0.00
Members' Fees.....	70.00	Fees to General Treasurer..	70.00
Grant from General Council	46.35	Postage and Stationery.....	7.95
Bank Interest.....	1.42	Expenses re Meeting.....	.75
For Handbooks, etc.....	2.75	Books, Printing, etc.....	15.95
		Magazines, etc.....	7.92
		Refreshment Committee....	15.20
		Handbooks.....	1.75
		Balance carried forward....	96.17
Totals.....	$145.69		$145.69

OFFICERS FOR 1940

The Secretaries of the various Centres report the following officers elected for 1940.

Toronto Centre

Honorary Chairman—Dr. C. A. Chant
Chairman—S. C. Brown
Vice-Chairman—Dr. D. W. Best
Secretary—F. L. Harvey, 80 Gates Ave.
Recorder—Miss Ruth J. Northcott, M.A.
Treasurer—T. H. Mason
Curator—R. S. Duncan
Council—Dr. D. S. Ainslie; Dr. L. Gilchrist; Dr. J. F. Heard; Dr. F. S. Hogg; J. H. Horning; Dr. P. M. Millman; Rev. C. H. Shortt; Tracy D. Waring; Dr. R. K. Young; and Past Chairmen—A. F. Miller; A. F. Hunter; J. R. Collins; A. R. Hassard; and E. J. A. Kennedy

Winnipeg Centre

Honorary President—Monsignor T. W. Morton.
President—Mr. L. J. Crocker
First Vice-President—Mr. C. A. E. Hensley
Second Vice-President—Miss O. A. Armstrong
Treasurer—Mr. R. S. Evans (10 Ruskin Row)
Secretary—Miss Margaret E. Watterson, 612 Toronto General Trusts Bldg.
Press Secretary—Miss O. A. Armstrong, 520 Maryland Street
Council—Mrs. J. Norris; Dr. L. A. H. Warren; Rev. Father Burke-Gaffney; Messrs. V. C. Jones; W. R. Junkin; L. W. Koser; H. E. Riter; A. W. Smith; and R. D. Colquette (past president)

Ottawa Centre

Honorary President—John McLeish, B.A.
President—Miriam S. Burland, B.A.
First Vice-President—F. W. Matley, Esq.
Second Vice-President—T. L. Tanton, Ph.D.
Secretary—Malcolm M. Thomson, B.A.
Treasurer—Andrew C. Steedman, B.A.
Council—Hoyes Lloyd, M.A.; C. B. Reilly, K.C.; W. W. Nichol, B.A.; R. G. Madill, B.A.; and A. H. Miller, M.A. (Oxon)

Montreal Centre

Honorary President—Mgr. C. P. Choquette
President—Frank J. de Kinder
Vice-President—Prof. A. H. S. Gillson
Secretary-Treasurer—Henry F. Hall, Sir George Williams College, Montreal (1441 Drummond St.)
Council—Dr. C. C. Birchard; O. A. Ferrier; G. Harper Hall; G. R. Lighthall; W. E. Lyman; E. R. Paterson; J. Addison Reid; Dr. A. Norman Shaw; A. M. Donnelly; F. P. Morgan

London Centre

Honorary President—Dr. H. R. Kingston
President—Rev. W. G. Colgrove
Vice-President—T. C. Benson
Secretary-Treasurer—Dr. G. R. Magee, 427 William St.
Council—Miss S. Livingstone; D. M. Hennigar; O. Kilburn; E. E. O'Connor; M. O. Culbert; and Past President J. Higgens

Victoria Centre

Honorary President—Lt.-Com'dr H. R. Tingley
President—Robert Peters
First Vice-President—R. M. Petrie, M.A., Ph.D.
Second Vice-President—Capt. Wm. Everall
Secretary-Treasurer—Miss Phoebe Riddle, 804 Seymour Avenue
Recorder—K. O. Wright, M.A.
Librarian—Miss C. Hailstone
Council—L. Hopkins; Miss K. Langworthy; Dr. A. McKellar; O. M. Prentice; James Smith; W. A. Thorn; A. H. Young; and Past Presidents G. Shaw and H. Boyd Brydon

Hamilton Centre

Honorary President—W. T. Goddard
President—N. H. Broadhead
Vice-President—Rev. E. F. Maunsell
Curator—T. H. Wingham
Secretary-Treasurer—H. B. Fox, 257 Balmoral Avenue N.
Council—Dr. Wm. Findlay; Dr. A. E. Johns; J. A. Marsh, M.P.; Geo. E. Campbell, M.A.; E. E. Bossence; F. H. Butcher, B.A.; Wm. D. Stewart

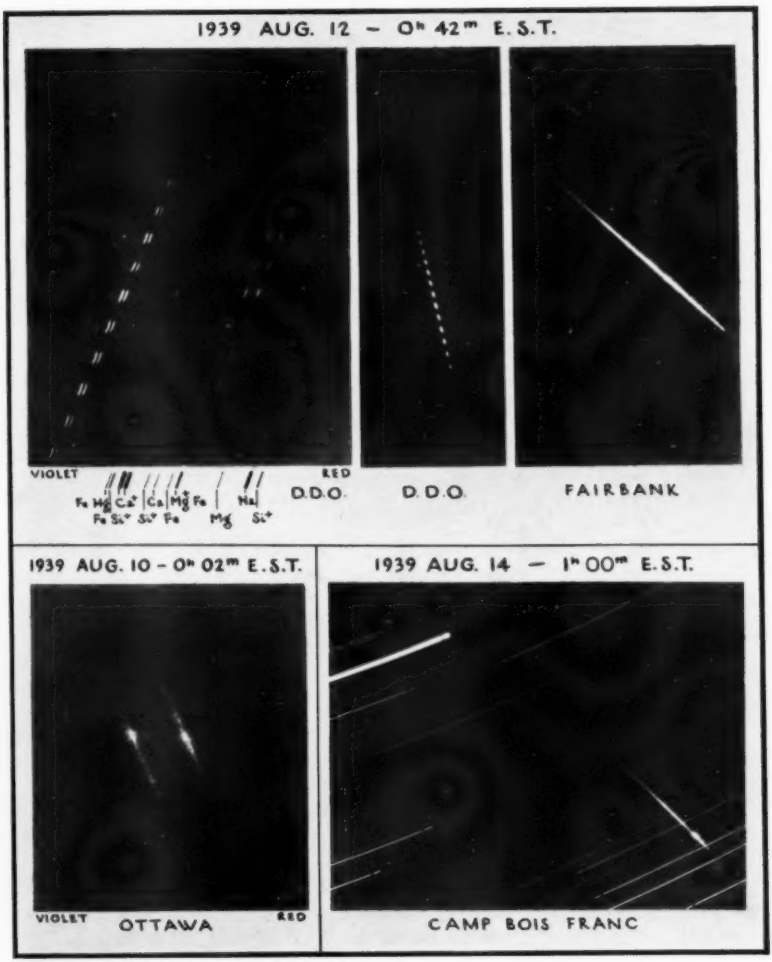
Vancouver Centre

Honorary President—Dr. J. A. Pearce
President—C. A. McDonald
Vice-President—Dr. A. M. Crooker
Corresponding Secretary—Dr. K. C. Mann, University of British Columbia
Recording Secretary—Dr. H. D. Smith
Treasurer—Mrs. Laura Anderson
Council—C. Jorgensen; Mrs. C. A. Rogers; E. C. Thrupp; F. R. Stewart; A. Outram; Dr. R. Hull; C. E. Bastin; N. D. B. Phillips

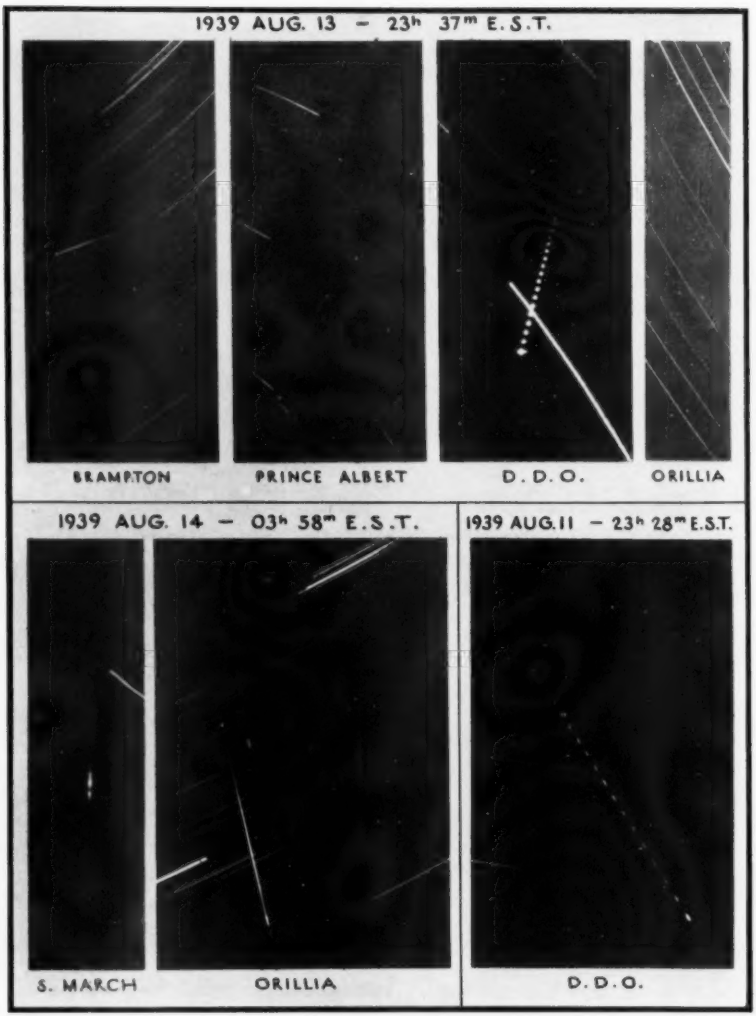
Edmonton Centre

Honorary President—Dr. J. W. Campbell
President—Mr. John Blue
Vice-President—Mr. H. B. Doughty
Secretary—Dr. E. H. Gowan
Treasurer—Mr. E. N. Higinbotham
Librarian—Mr. E. S. Keeping
Council—Mr. W. O. Coulman; Mrs. J. A. Clarke; Messrs. C. G. Wates; W. A. McAulay; C. P. Willoughby
Social Hostesses—Mrs. J. G. Taylor; Miss A. Smith

PLATE VI



Spectra (left), and Direct Photographs (right) of three Perseid Meteors.



Direct Photographs of three Perseid Meteors.

Journal of the Royal Astronomical Society of Canada, 1940.

METEOR NEWS

Observations relating to meteors and meteorites are cordially invited.

THE PERSEID METEOR SHOWER, 1939* (with plates VI and VII)

The annual Perseid meteor shower of 1939 fell due at the dark of the moon and owing to this fortunate circumstance a special effort was made to have efficient co-operation between observing parties in Ontario and Quebec. In particular the photographic programme was stressed and an attempt was made to have at least one camera used at every visual station. The fact that seventeen stations employing a total of thirty-one cameras co-operated in the photographic programme indicates the growing interest in this important branch of meteor study. The result of forty-three meteor photographs secured on the five nights of observation well demonstrates the scientific value of such interest. I would like to point out that the successful completion of this programme would have been quite impossible without the enthusiastic support of a large number of amateurs who co-operated efficiently with the Dominion Observatory in Ottawa and the David Dunlap Observatory in Richmond Hill.

The Canadian observers enjoyed unusually favourable weather during the five nights scheduled for work, August 9-14. Clouds seriously interfered on only one night, that of August 12-13. The most unfortunate occurrence in connection with the shower, however, was an extremely brilliant auroral display on August 11-12. This lasted all night and for most of the time extended over the whole sky. The result was that on this night all faint meteors were blanked out by aurora, making the rates unreliable. In addition to this fact the attention of observers was distracted, magnitude estimates of the meteors that were seen were difficult to make, and the photographic programme suffered greatly since the majority of the plates taken were badly fogged and many observers gave up trying to expose the cameras. In spite of the aurora the observations on this night produced fair results as will be seen below.

*Communication of the David Dunlap Observatory, No. 5

Two stations were organized for both photography and visual work by Malcolm M. Thomson and Miss Miriam S. Burland of the Dominion Observatory, Ottawa. One of these was located at the observatory and the other at South March. Mr. Thomson and Miss Burland are also responsible for the reduction of the visual observations from the above two stations. The London Centre of the Society again had a good sized party out, organized by John Middlebrook. We are glad to be able to report again observations from a group of scouts at Camp Bois Franc, near Montreal. This group, as in the past, was organized by E. Russell Paterson who this year, with marked success, added photography to his programme. The Y.M.C.A. camp at Torrance also contributed observations. Particularly active in the photographic programme were Jack Grant in Orillia, Emerson Bullock at Brampton, A. H. Tiplin at Queenston Hts., and Bert Topham at his own amateur observatory in Fairbank. Observations with a spectrograph as well as direct camera were carried out from two locations by S. C. Brown, chairman of the Toronto Centre of the Society. Miss R. J. Northcott of the Dunlap Observatory made exposures with her camera at Prince Albert while G. E. Longworth, also of the Observatory staff, added his camera to the others being used at Richmond Hill on August 11-12. The complete list of those who assisted in the meteor observations is given below, the names preceded by an asterisk being those who took part in the meteor photography as well as the visual work.

PERSEID OBSERVATION GROUPS—1939

1. *David Dunlap Observatory*—H. G. Byers, R. B. Laing, *G. E. Longworth, Dr. D. W. R. McKinley, Miss M. McKinley, *P. M. Millman, D. Montmorency, Miss E. Robinson, A. L. Schawlow, George Wilson, Jr.
2. *Dominion Observatory, Ottawa*—Miss Miriam S. Burland, Miss Kathleen Cross, Miss Dorothy Jolly, Miss Gladys Jolly, Miss Allison Knauff, Miss Jean MacLean, Miss Margaret McPherson, Miss Maysie O'Rourke, Miss Marion Vallillee, *Stanley Metcalfe, *Dick Ostrom.

2a. *South March, Ont.*—Gordon Blenkarn, Lorne Gardiner, Fred Greenwell, Walter Krzyzewski, Douglas McPherson, Stanley Mott, Sam Palef, Emile Potvin, Frank Stone, *Malcolm M. Thomson.

3. *London, Ont.*—Major E. H. Anundson, Mrs. B. W. Beattie, B. W. Beattie, C. Boam, F. A. Botari, Rev. W. G. Colgrove, M. O. Culbert, Mr. Freeman, C. Gallagher, Prof. H. R. Kingston, Miss Livingstone, Dr. G. R. Magee, *J. Middlebrook, Albert Stevens, Arthur Tayler, Mrs. C. J. Tayler, C. J. Tayler.

4. *Camp Bois Franc, Que.*—*E. Russell Paterson, K. Aldridge, A. Coley, R. Cronin, W. Eperson, J. Finer, A. Gilbert, G. Loggie, P. Pedersen, F. Roche, J. Soden, J. Westwater.
5. *Kingsway, W. Toronto*—*S. C. Brown, H. L. Ward.
6. *Castlefield Observatory, Fairbank, Ont.*—*Bert Topham.
7. *Dwight, Ont.*—Mrs. R. M. Millman, *R. N. Millman.
8. *Brampton, Ont.*—*E. W. Bullock.
9. *Orillia, Ont.*—*Jack Grant.
10. *Timmins, Ont.*—*R. Vaughan.
11. *Queenston Heights, Ont.*—Miss K. Prebble, Robert Price, *A. H. Tiplin.
12. *Prince Albert, Ont.*—Miss Evelyn Irwin, *Miss Edith Leach, *Miss R. J. Northcott.
13. *Gore's Landing, Ont.*—P. H. Clegg, *R. A. Harris.
14. *Fenelon Falls, Ont.*—*S. C. Brown, H. L. Ward.
15. *Markham, Ont.*—D. Montgomery, George Wilson, Jr.
16. *Kincardine, Ont.*—George Wilson, Jr., A. J. Woods.
17. *Bethel, Vt.*—W. W. Parker.
18. *St. Ephrem Station, Que.*—Louis Mathieu.
19. *Hamilton, Ont.*—Douglas Terry.
20. *Guelph, Ont.*—W. T. Patterson.
21. *Montreal, Que.*—De Lisle Garneau.
22. *Cambridge, Mass.*—*D. A. MacRae.
23. *Torrance, Ont.*—Julian Brace, Kenneth Brown, Dixon Goodrick, Dick Houston, C. R. Lounsbury, George Martin, Hugh Martin, Ernest Rattray, George Shephard, George Slater, Robert Wardlaw.
24. *Port Hope, Ont.*—David D. Perry.
25. *Winchester, Ont.*—James Carlyle, Robert Larocque.
26. *Barbers Bay, Ont.*—*Stuart Scott.

The visual observations were carried out much as in former years, the total number of meteors seen from each station being recorded. In most cases these were divided into Perseids and Non-Perseids. At some of the stations only the brighter meteors were plotted. This applies particularly to Groups 2, 2a, and 4. Table I lists the actual number of meteors observed by the various groups. Wherever a continuous watch of the sky was carried out the total minutes observed are recorded in the fifth column. In a number of cases the sky was observed only sporadically in the intervals between looking after cameras and here no figure for minutes observed has been entered. The average number of observers watching the sky at any given time is found in column three. In most cases, except when a single individual manned a station, there was a recorder in addition to the number of observers given in the table. The hourly rates, reduced to six observers by

TABLE I

VISUAL OBSERVATIONS OF THE PERSEIDS, 1939

Date	Group No.	Average No. of Observers	Observing Period (E.S.T.)	Total Minutes Observed	Meteors Observed P	Meteors Observed N	Weather Factor
Aug. 9–10.....	1	2	11.45– 3.35	230	46	19	9
	2	3	11.30– 2.15	165	45		8
	2a	6	11.10– 2.20	190	51	69	6
	4	6	10.50–11.10	20	7	1	2
	9	1	10.40– 2.00		8	0	10
	13	1	10.40– 2.20		7	7	10
	19	1	10.00–10.30	30	3		8
	20	1			1	0	
Aug. 10–11.....	1	1	11.05– 3.50	285	43	8	9
	2	5	11.00– 4.00	300	263		10
	2a	5	11.40– 4.00	260	241	105	10
	5	1	11.05– 3.50	210	53	7	9
	6	1	8.50–10.40		5	1	
	8	1	10.20– 3.20	270	29	17	10
	9	1	10.30– 3.30		4	2	10
	11	2	11.10– 4.00	270	61	33	10
	12	1	8.50–11.10	120	11	13	10
	13	1	10.20– 3.30		15	8	10
	15	2	8.45–11.15	150	33		10
	17	1	8.25– 9.35	70	21		7
	18	1	10.30–11.30		5	0	
	19	1	10.00–11.00	60	7		10
	20	1	10.00–11.30		3	0	
	21	1	8.35–12.10		53		10
	25	2	3.15– 4.00	45	29		10
Aug. 11–12.....	1	3	11.00– 4.00	300	79	24	5
	2	4	11.00– 3.30	270	108		5
	2a	6	10.35– 3.45	310	119	54	5
	3	4	9.10– 2.20	300	41	15	5
	4	10	10.45– 1.45	180	113	69	5
	5	1	11.50– 2.40	120	18	1	5
	6	1	1.15– 4.45		17	2	5
	8	1	11.45– 4.05	240	34	6	5

TABLE I—*Continued*

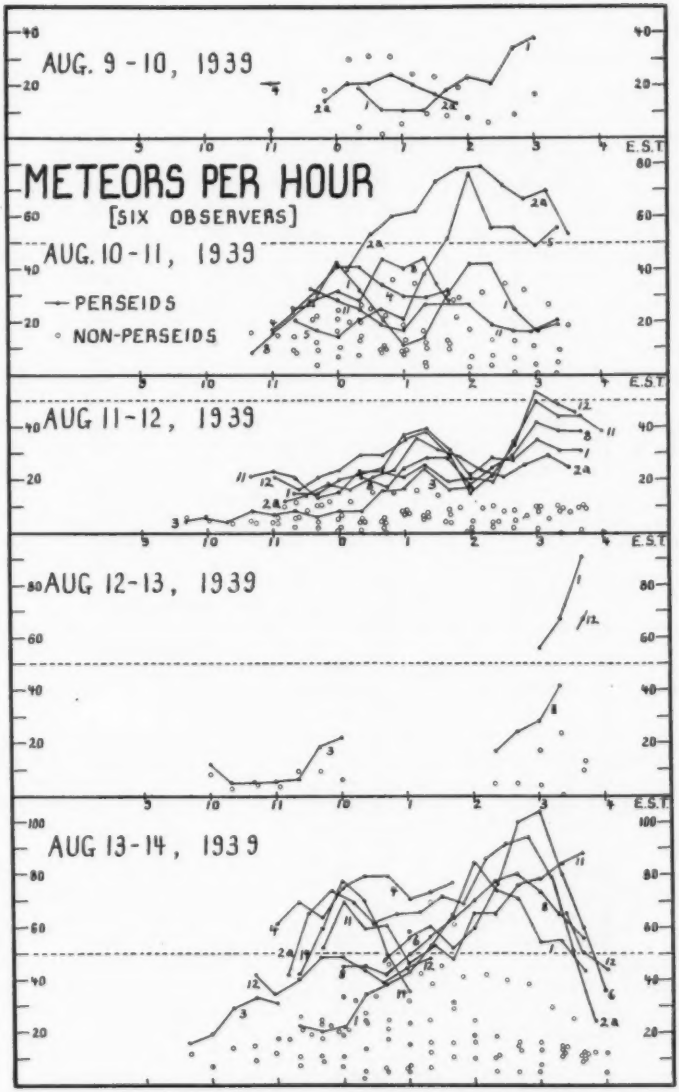
Date	Group No.	Average No. of Observers	Observing Period (E.T.S.)	Total Minutes Observed	Meteors Observed P	Meteors Observed N	Weather Factor
Aug. 11–12.....	9	1	12.00– 4.20		4	0	5
	11	2	10.10– 4.25	360	87	11	5
	12	2	10.00– 4.10	340	86	12	5
	13	1	10.30– 4.00		16	2	5
	17	1	8.45– 9.15	30	10		5
	19	1	10.00–10.30	30	4		5
	20	1	9.30–11.00		5	1	
Aug. 12–13.....	1	1	2.30– 4.00	50	21	5	6
	3	3	9.30–12.20	170	24	13	4
	8	1	1.50– 3.50	100	17	1	6
	9	1	3.10– 3.40		2	0	6
	10	1	11.20– 1.50	140	33	7	4
	12	2	3.00– 4.20	80	38	5	8
	17	1	10.30–11.00	30	4		4
	20	1	11.00–12.30		4	0	
Aug. 13–14.....	1	2	11.00– 4.00	300	119	51	10
	2	5	10.45– 4.00	315	307		10
	2a	4	10.55– 4.15	320	285	137	10
	3	3	9.10–11.30	140	37	20	10
	4	4	10.38– 1.53	195	192	108	10
	6	1	12.40– 4.30	210	64	9	9
	7	1	10.30–11.50	40	5	0	5
	8	1	11.30– 4.10	250	77	27	10
	9	1	9.50– 4.00		10	2	10
	11	2	11.15– 4.10	280	168	36	10
	12	2	10.25– 4.20	280	105	17	10
	14	1	10.45– 2.25	200	38	9	10
	15	1	9.35–11.25	110	24		10
	16	2	10.10–11.10	60	35		10
	23	6	9.30– 2.35	305	168		10
Aug. 14–15.....	24	1	12.00– 2.20	140	64		10
Aug. 15–16.....	23	6	10.12– 2.00	228	149		8

Total meteors observed—**4709.**

the factors given in the JOURNAL vol. 28, p. 139, 1934, have been plotted in Figure 1. Here each plotted point represents the mean rate for the sixty minutes centered at the corresponding position. The numbers accompanying the plotted rates are the group numbers listed above.

Owing to the unfortunate circumstance of the aurora on August 11-12, and clouds on August 12-13, it is difficult to determine the exact time of the Perseid maximum from these observations. The average rates were definitely higher on August 13-14 than on August 10-11 so that apparently the maximum was later than the night of August 11-12. The observed magnitude distributions are listed in Table II. Here the observations of August 11-12 have been separated from the others in all cases. It seems that, except for C. Bois Franc, the mean magnitude of the meteors observed on the night of the aurora was 0.7 magnitudes brighter than on the other nights. If this difference were free from systematic error it would mean that the aurora cut the observed rates almost in half, but it may have had an even greater effect. The tendency on the part of most observers would be to estimate the meteors too faint on the night of a brilliant aurora so that the true difference in mean magnitude may have been considerably greater than 0.7. The actual rate on August 11-12 was probably as high as on August 13-14. All groups agree in indicating a definite drop in the Perseid rate at 2 a.m. on August 11-12. This probably marks an actual thin spot in the shower as the aurora was not noticeably more brilliant at this time than for the two hours preceding. A similar drop in rate, though less marked, is seen at 1 a.m. on August 13-14. On comparing the 1939 Perseid rates with previous years it appears that this last Perseid return was not outstanding for its strength. Probably about the same number appeared as in 1938, a few more than in 1937, but not as many as in 1934 and 1935. Again in 1939 as in 1938 the shower was marked by the absence of any outstanding or very bright meteors.

The details of the photographic programme are summarized in Table III. Date and station are listed first, followed in the third column by the total number of exposures made at one station, next the total number of hours exposure made with all cameras, then the number of meteors photographed, the average weather factor, and finally the speed of the various cameras used. It will be seen that



Visual hourly rates for the Perseid meteors, 1939.

TABLE II—MAGNITUDE DISTRIBUTIONS
Aug. 9-10, 10-11, 12-13, 13-14.

Station		−4	−3	−2	−1	0	1	2	3	4	5	6	Total	Mean Mag.
D. D. O.....	P		1	8	11	23	58	51	44	18	6	1	221	1.7
	N			2	7	10	14	11	17	12	4		77	1.9
D. O.....	P+N			5	4	32	59	157	183	104	17		561	2.5
S. March.....	P	1	2	15	46	87	71	121	104	36	4		487	1.5
	N		2	8	7	18	26	76	89	36	2	1	265	2.2
Bois Franc	P				1	18	44	57	66	12			198	2.0
	N					6	14	28	50	11			109	2.4
Others.....	P			6	7	26	88	150	117	30	17		441	2.1
	N				1	3	16	37	28	18	2		105	2.4
Aug. 11-12 (Aurora)														
D. D. O.....	P			2	5	16	20	10	5	3	1		62	0.9
	N			1	2	5	7	1	1	2			19	0.8
D. O.....	P+N				6	11	26	40	21	4			108	1.7
S. March.....	P		1	6	19	23	20	24	20				113	0.8
	N		1	1	3	6	13	13	17				54	1.5
Bois Franc	P				1	15	10	27	38	24	3		118	2.4
	N					6	14	28	50	11			109	2.4
Others.....	P				6	14	46	67	20	1	1		155	1.6
	N					1	4	8	9	1			23	2.2

TABLE III—PERSEIDS, 1939 (Spectrophotography)

Date	Station	No. Exposures	Total Exposure Time	Spectra Photographed	Weather Factor	Cameras
Aug. 9–10..	D. D. O.....	12	16.2 hrs.		10	4.5, 4.5, 4.5, 4.5, §
	D. O.....	9	4.5	1	8	4.5, 3.8, 3.5,
Aug. 10–11.	D. D. O.....	16	22.6		10	4.5, 4.5, 4.5, 4.5, §
	D. O.....	13	9.4		9	4.5, 3.8, 3.5
	Kingsway....	4	3.0		10	4.5
	Brampton....	8	5.0		10	4.5
Aug. 11–12.	D. D. O.....	32	22.3	1	5	4.5, 4.5, 4.5, 4.5, §
	D. O.....	20	8.6		5	4.5, 3.8, 3.5,
	Kingsway....	4	3.0		5	4.5,
Aug. 12–13.	D. D. O.....	12	9.3		4	4.5, 4.5, 4.5, 4.5, §
Aug. 13–14.	D. D. O.....	16	23.1		10	4.5, 4.5, 4.5, 4.5, §
	D. O.....	10	6.7		10	4.5, 3.8, 3.5,
	Fenelon Falls.	6	3.6		10	4.5,
		162	**137.3**	**2**		

TABLE III—*Continued*

PERSEIDS, 1939 (Direct Photography)

Date	Station	No. Exposures	Total Exposure Time	Meteors Photographed	Weather Factor	Cameras
Aug. 9–10...	D. D. O.....	12	8.2 hrs.	2	10	3.5, 2.0, §
	D. O.....	4	2.0		8	4.5,
	Orillia.....	20	8.9		10	8, 6.3, 1.9,
	Gore's Landing ..	7	3.2		10	4.5,
	Barber's Bay	1	0.5		10	4.5
		44	**22.8**	**2**		
Aug. 10–11..	D. D. O.....	16	11.5	2	10	3.5, 2.0 §
	D. O.....	5	3.4		10	4.5
	S. March.....	10	3.5		10	3.8, 3.5
	Kingsway.....	3	1.3		9	3.5
	Fairbank.....	7	2.4	1	10	2.0
	Dwight.....	2	1.7		5	6.3
	Brampton.....	12	4.7	2	10	2.5
	Orillia.....	39	16.0	1	10	8, 6.3, 1.9
	Queenston.....	6	4.2	1	10	4.5
	Gore's Landing ..	9	5.2		10	4.5
	Cambridge.....	4	3.8			3.8
		113	**57.7**	**7**		
Aug. 11–12..	D. D. O.....	36	12.7	4	5	3.5, 2.8, 2.0, §
	S. March.....	1	0.2		3	3.5
	London.....	9	3.7		4	6.5, 5.6
	Kingsway.....	1	0.6		5	3.5
	Fairbank.....	16	3.3	3	5	2.0
	Brampton.....	12	4.5		5	2.5
	Orillia.....	30	8.6	1	5	8, 6.3
	Queenston.....	7	3.9		5	4.5
	Prince Albert....	6	0.8	1	5	4.5
	Gore's Landing ..	11	2.7	1	5	4.5
		129	**41.0**	**10**		

TABLE III—*Continued*

PERSEIDS, 1939 (Direct Photography)

Date	Station	No. Exposures	Total Exposure Time	Meteors Photographed	Weather Factor	Cameras	
Aug. 12–13..	D. D. O.....	12	4.5 hrs.		5	3.5, 2.0,	§
	London.....	8	7.5		4	6.5, 5.6	
	Brampton.....	5	1.8	1	5	2.5	
	Orillia.....	16	4.8	1	6	8, 6.3, 1.9	
	Timmins.....	5	2.4		8	3.5	
	Prince Albert....	1	0.6		5	4.5	
		47	**21.6**	**2**			
Aug. 13–14..	D. D. O.....	17	11.8	4	10	3.5, 2.0,	§
	D. O.....	3	1.9		10	4.5	
	S. March.....	14	6.2	1	10	3.8, 3.5	
	London.....	2	1.6		7	6.5	
	C. Bois Franc....	6	2.9	4	9	4.5	
	Fairbank.....	7	1.5		10	2.0	
	Dwight.....	2	1.0	1	5	6.3	
	Brampton.....	7	4.1	2	10	2.5	
	Orillia.....	46	17.5	4	10	8, 6.3, 1.9	
	Queenston.....	6	5.8	1	10	4.5	
	Prince Albert....	9	3.8	1	10	4.5	
	Fenelon Falls....	7	3.2	2	10	3.5	
		126	**61.3**	**20**			

§Rotating shutter used.

SUMMARY

Aug. 9–14...	Spectro-photography...	162	137 hrs.	2		
Aug. 9–14...	Direct photography...	459	204	41		
		621	**341**	**43**		

in a total of 621 exposures, representing an exposure time of 341 hours, 43 meteor photographs were secured. These include two spectra which will probably be Numbers XLVI and XLVII on the complete list of meteor spectra for the world. These spectra were taken at the Dominion and Dunlap Observatories respectively. The average of total exposure time for each direct meteor photograph secured was five hours, which is about normal. The average for each spectrum was 64 hours, considerably higher than one would expect. The absence of very bright meteors accompanying the shower in 1939 accounts for the fact that more spectra were not secured.

A new camera mounting was put into use for the first time at the Dunlap Observatory during this programme. This mounting combines four meteor spectrographs with two direct cameras so that a field approximately 40 degrees in radius is well covered. The prisms of the spectrographs are placed to give maximum dispersion for meteors radiating from the centre of the field. A rotating shutter, driven by a synchronous motor, covers all six lenses 25 times a second. Each camera is exposed for one-third of the time and covered for two-thirds of the time. This greatly reduces sky fog without cutting down the numbers of meteors photographed. It also makes possible the accurate determination of the apparent angular velocity of a meteor. This may be converted to true geocentric velocity if a second photograph of the same meteor is secured from another station.

The 43 meteor photographs obtained represented 27 different meteors, 24 Perseids and 3 Non-Perseids. In 23 cases visual magnitude estimates were made, giving a magnitude distribution as follows:—

Magnitude	−2.5	−1.5	−1	−0.5	0	1	2	Total	Mean Mag.
Meteors Photographed	2	1	5	1	9	3	2	23	−0.2

It is probable that some of these magnitudes were estimated too faint owing to the brilliant aurora. Of the 27 meteors

1 was photographed from 4 stations
3 were " " 3 "
5 " " " 2 "

In other words, out of the 43 photographs secured, 25 were of the nine meteors photographed in duplicate, all Perseids. Accurate

velocities and heights will be available for seven of these, observed with the rotating shutter. For the other two heights only can be determined. All things considered the results of the photographic programme must be regarded as highly satisfactory and those who so ably assisted in this work at the various stations are to be congratulated upon the co-ordination they achieved.

Representative examples of the Perseid photographs are reproduced in Plates VI and VII. It was noted that the 27 meteors could be divided, rather arbitrarily, into the following four classes on the basis of the appearance of the photographic trail.

	No. of Meteors	Mean Visual Mag.
1. Very short even trails (duration 0.2 sec. or less)	8	+0.5
2. Longer even trails	9	+0.1
3. Trails with single short but definite terminal burst	6	−1.2
4. Trails with three or more terminal bursts	4	−1.0

There is no very sharp line of demarkation between the first two classes, both of which correspond to Miss Hoffleit's Type I*. The last two correspond to Miss Hoffleit's Type II. The meteors with bursts were definitely brighter than those without and the increase in brightness from class 1 to class 4 is even more marked from a study of the density of the meteor trails on the plates. It remains to be seen what relation exists between height and the various classes. Fortunately heights will be available for at least two meteors in each class. The durations of the photographic trails for the twelve meteors observed with the rotating shutter at the Dunlap Observatory were from 0.2 to 0.8 seconds with a mean value 0.4 seconds.

Both the spectra secured are apparently of Type Y, that is they show the H and K lines of ionized calcium. They were taken on fast panchromatic film, Agfa Super-Pan Press in the case of the Ottawa spectrum, and Eastman Super XX in the case of the one photographed at the Dunlap Observatory. Examination of Plate VI will make it evident that both meteors became bluer towards the end of the path (the Plate is so oriented that all the meteors are moving downwards). Twenty-nine lines were measured in Spectrum XLVII (secured at the Dunlap Observatory) and the

*Proc. N.A.S. vol. 19, p. 212, 1933.

wavelengths determined for the strongest of these are listed below together with the tentative identification.

Wavelength		Identification
3832	diffuse	Mg, Fe
3858		Fe, Si+
3933	very strong	Ca+
3969	very strong	Ca+
4132	weak	Si+
4227	weak	Ca
4385	weak	Fe
4486		Mg+, Fe
5177	weak	Mg
5893	strong	Na
6342		Si+
6437	diffuse	

This spectrum is of fairly high excitation as evidenced by the strength of the ionized lines of calcium and magnesium compared to the neutral lines of the same elements, and by the presence of ionized silicon. This meteor was photographed in a region of heavy auroral intensity though it is doubtful if this fact had any marked effect on the spectrum. The strength of the D lines of sodium is in satisfactory agreement with the early visual observations of meteor spectra. It will be noted that the chief elements appearing in this spectrum are all common constituents of stone meteorites. A more complete study of both these meteor spectra will appear later.

In summary, the observations of the Perseid meteor shower, carried out in Ontario and Quebec in 1939, resulted in securing visual observations of 4,709 meteors and in obtaining 41 meteor photographs with direct cameras and two with spectrographs. Nine meteors were photographed in duplicate. In other words a large amount of valuable photographic material on meteors has been secured in a short time. May I here express my hearty thanks to all those who contributed so willingly to the success of these observations and assure them again that their co-operation is greatly appreciated and of very real scientific value. It is hoped that in the future many other programmes of meteor observation may be carried out in Canada with an enthusiasm which will produce correspondingly valuable results.

PETER M. MILLMAN

David Dunlap Observatory,
Richmond Hill, Ont.

NOTES AND QUERIES

Communications are invited, especially from amateurs. The Editor will try to secure answers to queries.

New Appointment for Mr. Andrew Thomson

Mr. John Patterson, Controller of the Meteorological Services, has notified us that Mr. Andrew Thomson, M.A., F.R.S.C., has been appointed Assistant Controller of the Meteorological Service of Canada. As has been mentioned in the January number of this Journal, Mr. Thomson is a very active member of the General Council of our Society. The editors congratulate him on this important appointment, and wish him every success in the great labour and responsibility which this position involves.

British Expeditions for the Solar Eclipse of October 1, 1940

The Joint Permanent Eclipse Committee of the Royal Society (London) and the Royal Astronomical Society has for several years been making extensive plans for a number of expeditions to observe the solar eclipse of October 1, 1940. Now, due to war conditions, the committee announces that all expeditions from Great Britain have been cancelled. It will, however, concentrate on one expedition from the Cape and Radcliffe (South Africa) Observatories, to be sent to Calvinia, Cape of Good Hope. At this station the duration of totality will be about 3 minutes 48 seconds, and the sun will be about thirty degrees above the horizon. The party will carry out as many of the original programmes as is practicable. It has been arranged that observations of the Einstein effect and the chromospheric spectrum will be included.

As this eclipse is well visible in eastern Brazil, where the duration is from three to five minutes, and the sun's altitude up to sixty degrees, it is expected that many American astronomers will take this opportunity of eclipse-chasing. The climatic conditions are unusually favourable in the dry plateau region of Brazil.

At present there are no definite plans for any Canadian expedition, though it would be very desirable that our country be represented at this relatively accessible eclipse when the parties from Great Britain have had to cancel their plans.

The New Observatory for University of Western Ontario

Elsewhere in this JOURNAL is a preliminary account of the building of a new Hume Cronyn Memorial Observatory in London, Ontario. Professor Kingston, the University, and the London Centre of our Society are to be heartily congratulated that this generous bequest has made possible the building of a fine observatory.

The Harvard Summer Conference on Astronomy

During the past few years the Harvard Summer Conferences have come to occupy a unique position in American astronomy. The large attendance of scientists from widely scattered universities and observatories has created unequalled opportunities for discussion of general and specific problems. The accompanying programme indicates the scope of the conference for the coming summer.

The fifth session of the Summer Conference on Astronomy will be held at the Harvard Observatory from July 1 to August 10, 1940. It is believed that many scientists and teachers will welcome the special opportunities for discussion and research available during the six-week session. Vistors who wish to use the plate collection or the instrumental equipment will be accomodated to the greatest possible extent. Colloquia will be conducted twice each week by staff members and visiting scientists.

The conference will include:

Topics in Celestial Mechanics—Prof. Dirk Brouwer, Yale University. A discussion of the theory and application of planetary perturbations.

The Internal Constitution of the Stars—Dr. T. E. Sterne and Dr. Martin Schwarzschild. An application of the laws of physics to steller interiors and a comparison of the results with observation; an introductory course.

Introduction to Astronomical Optics—Mr. James G. Baker. A treatment of the general problem of astronomical optics and numerous illustrations of the designing of specific types of instruments, both in theory and in practical details.

Photographic Photometry—Dr. Cecilia Payne-Gaposchkin and Dr. F. L. Whipple. A comprehensive discussion of the problems of photographic photometry found in the study of point-images, surfaces, and spectra.

Opportunities for research under guidance will be available in the topics of the conferences and in the following topics: Galaxies, Astrophysics, Variable Stars, Photoelectric Photometry, Meteors, and Meteorites.

Professor Shapley and Dr. Watson, assisted by visiting lecturers, will present a survey course: *Introduction to Cosmogony.* The lecturers will consider origins, processes, and destinies; the subjects will include stars, galaxies, the structure of

the universe, relativity, cosmic rays, the generation of stellar energy, ancient cosmogonies, mountain building, the age of the earth, planetary atmospheres, and the origin of the solar system. Among the visiting lecturers will be: Professor Henry N. Russell and Professor H. P. Robertson of Princeton University, Dr. Lyman Spitzer, Jr. of Yale University, Dr. R. E. Marshak of Rochester University, Professor Kirtley F. Mather and Dr. I. A. Getting of Harvard University, and Dr. Daniel Norman of the Harvard Observatory. There will be two lectures and one discussion group each week.

Further information may be obtained from the Harvard Observatory.

THE TORONTO MEETING OF THE A.A.V.S.O.

For the first time in its history, the American Association of Variable Star Observers will hold a meeting outside of the United States, when it comes to Toronto on May 31 and June 1 of this year, by invitation of the Toronto Centre of the Royal Astronomical Society of Canada. This Association is composed of a number of professional astronomers and a large number of amateurs who devote a great deal of time to observing with their own telescopes. It is rather fitting that the Association should meet here just now since Dr. Helen S. Hogg of the David Dunlap Observatory staff is the president, and the secretary, Mr. David Rosebrugh, lived in Toronto for many years.

The meetings will open with a public lecture at eight p.m. Friday evening, May 31, in the McLennan Laboratory, after which out-of-town visitors will be given an opportunity to look through the 74-inch telescope. There will be a session for papers at 10 a.m. Saturday at the David Dunlap Observatory. Luncheon will be served in the Richmond Hill United Church (for forty cents apiece). A brief meeting in the afternoon will be followed by an open house at the observatory.

The concluding event will be the evening dinner to be held in Toronto at the Great Hall, Hart House (about one dollar apiece). There will be several memorable speakers. As dinners are something of a rarity for the Toronto Centre it is hoped for a good turn-out of members to make this one a success.

The meetings (including the luncheon and dinner) are open to all who are interested in the study of astronomy. Reservations for the luncheon or dinner should be made as soon as possible with Mr. E. J. A. Kennedy, 198 College St., Toronto, or with Dr. Helen S. Hogg, Richmond Hill.

F. S. H.

MEETINGS OF THE SOCIETY

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LASKARIS, LEON. . . . . Warren County Observatory, Warren, Pa.
BERNARD, A. O. . . . . Renfrew Building, Calgary, Alberta
ORR, ROGERS. . . . . Box 625, Canadian, Texas
LAMBERT, WILBUR J. . . . . Creghan, New York
BARCROFT, D. P. . . . . First National Bank Bldg., Madera, Calif.
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CUTHELL, DUNCAN. . . . . 153 Mountjoy St., Timmins, Ontario
RENES, F. S. . . . . San Fernando, Cebu, Philippines
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BEDORE, E. L. . . . . Box 516, Napanee, Ontario
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LOWACK, CYRIL ANDREW. . . . . 821 N. Lockwood Ave., Chicago, Ill.
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SWENSSON, JOHN W. . . . . 2200 Bennett Ave., Evanston, Ill.
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HELM, CARL H. . . . . 321 East Broadway, Monmouth, Ill.
LORENZ, PHILIP B. . . . . 2320 Ridgeway Rd., Dayton, Ohio
American Association of Variable Star Observers, Harvard College Observatory, Cambridge, Mass.

THE SOCIETY'S AT-HOME

The Annual AT-HOME was held on Friday evening, January 26, 1940, in the Physics Building of the University of Toronto.

Those attending assembled in the large lecture hall, and Professor F. S. Hogg, Vice-President, took the chair. After welcoming the members and visitors from out of the city, Dr. Hogg introduced the President, Dr. William Findlay, who gave a very interesting address. Dr. Findlay spoke of conditions in the Society, the extent of its influence, the vigorous interest shown in some of the Centres, the privileges of membership, its publications, the valued

work done by many of its older members, and other recollections in reference to the present semi-centennial year of the R.A.S.C.

A very well prepared demonstration of photo-electric phenomena by Professor D. S. Ainslie, of the Department of Physics, followed.

The company then adjourned to the library upstairs, where refreshments were ready and a pleasant social hour was spent, new contacts were made, and prospective members got application forms.

AT WINNIPEG

February 14, 1940.—The regular monthly meeting of the Royal Astronomical Society of Canada, Winnipeg Centre, was held in Theatre "F", University Buildings, on Wednesday, February 14, at 8.15 p.m. The president, Mr. L. J. Crocker, was in the chair. The speaker for the evening was Mr. C. H. (Punch) Dickins, General Superintendent of Canadian Airways, whose subject was "Aviation and Astronomy."

He introduced the subject by saying that since man first strayed from his cave he has used stars for guidance and today even with all of the other special developments which aid in navigating the T.C.A. pilots are trained to make celestial observations to ascertain their positions.

Different instruments used for navigating have been the sun compass, earth inductor compass, magnetic compass and today the gyro compass.

Radio has changed the whole business of flying. By that means communication with the ground can be maintained and weather conditions discovered.

"Bush" fliers are interested in weather and hours of daylight. Here a challenge was thrown out to the society members to give a formula for finding sun rise and sun set times for latitudes north of 60 degrees.

Stratosphere flying for five thousand or more miles was stated to be a certainty of the future. The advantages are (1) weather disturbances are left below 25,000 ft., and (2) speeds of 500 miles an hour would easily be reached. The problems to be overcome are (1) maintaining the cabin's temperature and atmospheric pressure, (2) maintaining the engine's power, and (3) the propeller's resistance.

Mr. Dickins concluded by saying: "No doubt about the solution. However, it is a great advance from the bird-cage of 1908 to the modern streamlined airliner of today. We may well marvel that flights which yesterday were almost beyond belief are commonplace today—but surely this is the star—the guide that points to the future possibilities for man in the ocean of the air. Our destiny is near the stars."

AT VANCOUVER

October 10, 1939.—The sixty-fifth meeting of the Vancouver Centre was held at 8.15 p.m. in the Science Building of the University of British Columbia.

The president, Mr. C. A. McDonald, introduced the speaker of the evening, Mr. Sidney Smith, Vancouver barrister and retired naval officer, who spoke on the subject "The Defence of Merchantmen during the Last War." This topical subject had a wide popular appeal so that a good crowd turned out to hear a fine address. Mr. Smith launched his attentive audience into the fascinating problems of maintaining trade routes in time of war. This very vital problem for the British Empire has commanded the attention of the best of Britons since before the time of Nelson and has produced in return a rich national heritage. In turn the speaker dwelt on the devices of the enemy, submarine, torpedo and mine, and on the appropriate counter measures, camouflage, smoke-screen, zig-zag course, arming of merchantmen, Q-boats, depth charge, paravance gear, net-defense and finally the convoy system. Certainly the naval war was vigorously fought.

The use of camouflage can be understood only when fighting conditions at sea are considered. From the fact that most ships are sunk at dawn or dusk, naval artists concluded that the ship's colour should harmonize with the ruddy hues then prevalent.

The main device to be countered doubtless was the lurking, vulnerable submarine, its design complicated by the necessity of using two sources of motive power, fuel oil on the surface and electricity under water. These are best described as submersibles since they operate mainly on the surface and submerge only when attacked or stalking an enemy. Then they have but one eye, the ingenious periscope, an optical system in a tube thirty feet long and six inches in diameter, which is used only for a few seconds at a time at intervals of several minutes. From these short sights the crew must determine the distance, bearing, course and speed of the proposed victim. The sighting, manoeuvring, and calculation culminate in the discharge of the torpedoes. These deadly missiles, about eighteen feet long and fourteen inches in diameter, carry their cargo of about four hundred pounds of high explosive at speeds up to 45 knots, using self-contained compressed air motors. For distances greater than the usual range of around 1,000 yards, up to seven miles, the speed must be reduced. After their course is run, they sink. The roles of smoke-screens, zig-zag course, depth charges, Q-boats, and the convoy system in combating this menace were also dealt with in detail. It was pointed out that blind shots, torpedoes discharged with inadequate data in the hope of scoring a hit, were responsible for the loss of the "Lusitania" and "Courageous."

The menace of mines was met by the use of mine sweepers and the fitting of paravane gear to merchantmen. In the first operation two trawlers haul the ends of a long cable carrying at its centre a "kite" which determines the depth at which the cable is hauled. This cable catches the mooring cables on the mines which are cut by knives attached to the towed cable so that the mines rise to the surface when they are exploded by gunfire. Paravanes are submerged hydrofoils, towed by cables from the point of intersection of bow and keel, so constructed that they tend to drive away from the moving ship. Any

mine caught by the towing cable slides along it until it reaches the paravane, where a knife cuts the cable allowing the mine to rise to the surface to be destroyed. No ship fitted with paravane gear was mined during the last war. The final adoption of the convoy system turned the tide of naval warfare definitely in favour of the Allies.

Replete with interesting detail of a great navy from the introduction to the final dramatic description of the surrender and subsequent scuttling of the German navy, the lecture held the close attention of a large audience.

November 14, 1939.—The sixty-sixth meeting of the Vancouver Centre was held at 8.15 p.m. in the Science Building of the University of British Columbia.

Dr. C. S. Beals, of the Dominion Astrophysical Observatory at Victoria, arrived a few minutes late, as his boat had taken part in rescuing an airplane forced to land in the Gulf of Georgia. The audience was held repaid for their short wait by hearing a very interesting illustrated lecture on "A Visit to European Observatories." A part of this lecture has since appeared in the January number of the JOURNAL of the Society. The occasion of the visit, during the summer of 1939, was to attend the International Astrophysical Conference on Novae and White Dwarf stars held in Paris.

Dr. Beals very lucidly disposed of the business part of the trip, since the proposed evolution of a nova into a white dwarf was strenuously questioned. Apparently the tremendous radiation from a nova is much too small for such a theory to be correct. Further it appears that after a nova outburst, which statistically happens at least once to every star, the star returns approximately to its initial physical state. Thus the appearance of a nova marks no catastrophy but a little understood event in the normal evolution of a star. Dr. Beals expressed his opinion that the theorists would need better and more extensive data before they could interpret the nova phenomenon or the physical constitution of white dwarfs.

From France, his trip to Switzerland, Germany, Holland, England was next described. We were not only taken on a conducted tour of these countries, but learned interesting little details of their national history and customs. And we met personally the many outstanding astronomers in their observatories in our trip. The vividness of the trip was greatly emphasized by the use of Dufay colour transparencies in full natural colour. Our last pictures showed the "Normandie" and the "Statue of Liberty," which Dr. and Mrs. Beals saw with real relief a scant week before the outbreak of World War II.

A. M. CROOKER, *Secretary.*

The Royal Astronomical Society of Canada

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THE ROYAL ASTRONOMICAL SOCIETY OF CANADA
1890-1940

This year marks the completion of the first fifty years of the corporate existence of our Society. The Society was incorporated in 1890 under the name of The Astronomical and Physical Society of Toronto, and assumed its present name in 1903.

For many years the Toronto organization existed alone, but now the Society is national in extent, having active Centres in Montreal, P.Q.; Ottawa, Toronto, Hamilton and London, Ont.; Winnipeg, Man.; Edmonton, Alta.; Vancouver and Victoria, B.C. As well as about 700 members of these Canadian Centres, there are over 200 members not attached to any Centre, mostly resident in other nations, while some 300 additional institutions or persons are on the regular mailing list for our publications.

The Society publishes a monthly JOURNAL containing about 500 pages and a yearly OBSERVER'S HANDBOOK of 80 pages. Single copies of the JOURNAL or HANDBOOK are 25 cents, postpaid. In quantities of 10 or more copies, the price is 20 cents a copy.

Membership is open to anyone interested in astronomy. Annual dues, $2.00; life membership, $25.00. Publications are sent free to all members or may be subscribed for separately. Applications for membership or publications may be made to the General Secretary, 198 College St., Toronto.

The year 1940 also marks the hundredth anniversary of the founding in Toronto of the first Observatory (magnetic) in Canada. This was one of the first magnetic observatories in the world and became the nucleus of observatory development in Canada.

To mark the semi-centennial of the founding of our Society and the centenary of the founding of the first observatory, our Society plans to hold a special meeting in Toronto in the late summer. It is also planned to publish as a feature of the JOURNAL, articles and early documents dealing with the histories of the observatory and of the society.

The Society has for Sale:

Reprinted from the JOURNAL of the Royal Astronomical Society, 1936-1939.

The Physical State of the Upper Atmosphere, by B. Haurwitz, 96 pages; Price 50 cents postpaid.

The Small Observatory and its Design, by H. Boyd Brydon, 48 pages; Price 25 cents postpaid.

General Instructions for Meteor Observing, by Peter M. Millman, 18 pages; Price 10 cents postpaid.

Two Inexpensive Drives for Small Telescopes, by H. Boyd Brydon, 12 pages; Price 10 cents postpaid.

A. H. Young's Simple Mounting for the 6-inch Reflector, by H. Boyd Brydon, 16 pages; Price 10 cents postpaid.

Send Money Order to 198 College St., Toronto.